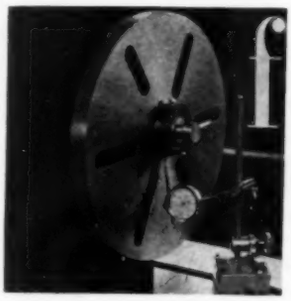
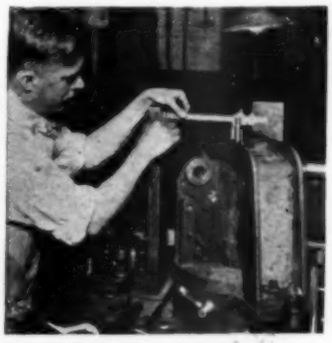
American Machinist

August 29, 1934

Tooling Technique and Profits



For all the mechanical departments of the up-to-date manufacturing enterprise, that where the tools are made, whether it be a part of the plant or an outside contract shop, is the most interesting to your real mechanic. Because that is where the accurate work is done that makes possible the marvels of modern interchangeable manufacture. And because that is where the highly skilled men of the industry, the master toolmakers of today, who occupy much the same position as the nearly vanished all-round machinist of yesterday, are to be found.



● Thanks to the precision of the machine tools and measuring instruments now available, these men work to accuracies that were scoffed at as visionary only a score of years ago, those of them who are fortunate enough to be with companies that understand the profit returned by the best in equipment. Back of them stand the engineer with his greatly improved designs, the metallurgist with his precise knowledge of the behavior and manipulation of metals, and the managers with their keener understanding of economies and psychology. Together they represent a powerful force in this civilization.

● Technique has its fascination for every mechanically minded man, but technique alone seldom leads to profits. Profits depend on technique plus the use of every business facility available, seasoned by the balanced judgment of experience.

● In this **Tool-Up Number** of *American Machinist,* which we are devoting to the toolrooms, the tool and die shops and the special machine shops of the industry, we have endeavored to gather articles and information on those facilities that lie ready to the hand of the men who operate the contract shops and the toolmaking departments. And we have been fortunate in drawing on the experience of some of the outstanding men in this field. Our only regret is that there has not been room in this number for all of the excellent material that was submitted to us. Some of it, consequently, will have to be published in later issues.

● To those who carry the responsibility of conducting profitably the shops and divisions where the tools of production—the jigs and fixtures and special devices that supplement the master tools of industry—we commend the following pages. And we urge them to give careful consideration to the economics of their industry; to the cooperative activities offered by the Special Tool, Die & Machine Shop Institute, and through their NRA code; to the use of engineering standards, of modern equipment and of accurate workmanship; to the improvement of industrial relations; and to the betterment of customer relations through proper selling, through good estimating procedure, and through adequate costing methods.

● Only thus will a group of independent units take on the full status of a coordinated industry.

Toolroom

MODERNIZATION

Replacement or rebuilding of toolroom equipment after a detailed study of every machine has brought to Cutler-Hammer cost reductions far beyond expectations

H. A. SEDGWICK
General Superintendent, Cutler-Hammer, Inc.

MACHINERY used by the toolroom in producing the most efficient results must be, above all else, extremely accurate if precision work is to result. Our company does today, and always has done, an unusual amount of tool work. To be certain that all of our machines used in connection with the manufacture of tools were of the most efficient type to enable our toolmakers to accomplish best results, our company recently conducted an extensive survey to determine the status of all such equipment and subsequently decided on a program of tool modernization, taking into consideration the great strides that have been made by builders of toolroom equipment during the last few years.

First we collected all the records of each machine. Write-off was checked and a careful visual inspection of the condition of each machine was coupled with the reports of foremen, assistants, and even the men operating the machines so that a proper evaluation of the machine's usefulness under present day conditions could be determined. From this survey, (based on facts and figures, plus an appreciation of the advantages of modern equipment) a decision was reached in the case of each machine—calling for modifications of present equipment or an outright substitution for those hopelessly obsolete machines that were considered a handicap to our workmen.

Among the first machines to have consideration were the lathes and milling machines. It was found that a number of these machines could be reconditioned to give satisfactory performance. Consequently this program was started—work being conducted on a few lathes at a time—and results have been entirely satisfactory. Several plain and universal milling machines were handled in the same manner.

An important machine in our work is a jig borer. We have in our tool room one of the very earliest machines of this type—with adjustment in thousandths of an inch. It is a large vertical milling machine equipped on all sides with scales and vernier adjustments, is of excellent precision and is now in first class shape. So far as the writer knows it has never had a milling cutter on its spindle. This machine was supplemented recently by another type of still greater capacity. The latter machine is also in perfect condition and both machines seem to provide all requirements that are now felt necessary.

We likewise inspected a number of miscellaneous drill presses, most of which are of the ball bearing type, and with few exceptions we were able to bring them into first class condition. Similarly, all vertical filing and sawing machines of the floor type were brought up to date, repairs being made where necessary.

Shapers were somewhat more of a problem—some were discarded; others were given more detailed inspections, repaired and placed back in use. While our latest shapers are still in first class condition, a very recent type developed by the machinery people—offered in medium stroke and with speeds up to 200 r.p.m.—appears to be ideally adapted to a large amount of our work. Another

A new vertical shaper with a 26-in. circular table gave excellent results when installed in place of a lighter machine

recent addition is a vertical shaper with 26-in. table replacing older machines of lighter construction.

Our molding die section utilizes a number of routing machines with 12-in. rotary tables and with high speeds of about 3,500 r.p.m.—wonderful machines in their day, but outclassed and outmoded by the latest developments of the manufacturers. They were replaced by new ones having nominal high speeds of 6,000 r.p.m. These new machines are equipped with duplicating tables, and one built particularly for us, of beautiful design, has spindle speeds of 12,000 r.p.m., and an exceptionally light ball bearing duplicating table of aluminum alloy. This section of the tool department has also recently been equipped with several makes and types of both air and motor driven hand files and polishers for efficient finishing of so called hot and cold molding dies.

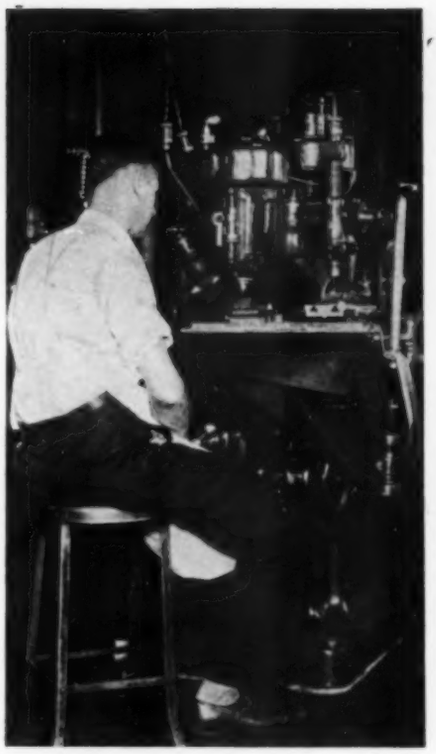
In the inspection division we have added new surface plates, dividing heads, small gaging tools, etc., solely in the interest of production accuracy and now we are investigating the "Comparator," a machine once considered not adapted to our work but now thought to be entirely so from any angles.

Electric Furnace Added

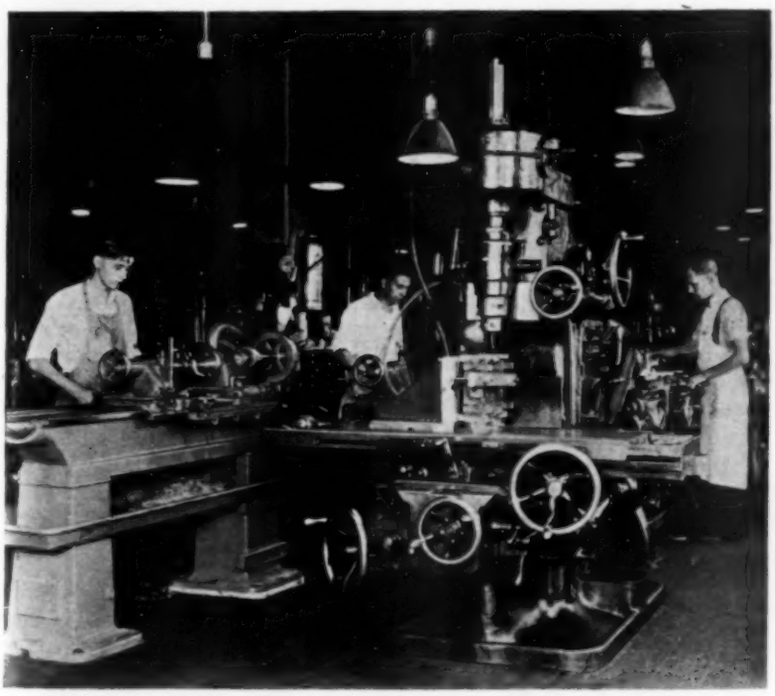
The tool hardening department sometimes gets little recognition as an important factor in the making of good tools. We have given serious consideration to this work with marked results. Although we have had several small and large gas furnaces and an electric furnace for several years, we have lately added a double 12-in. electric furnace with controlled atmosphere and feel convinced that the hardening department can now produce the highest type of work that may be required of it.

Although the explanation given above summarizes most of the work actually accomplished, this survey is still in process and being applied to grinders, the addition of separate motor driven spindles, hydraulic and mechanical test presses, complete revision of tool supply inventory and tool exchange systems, etc. We feel naturally that we have gone a long way in providing our people with the best possible type of equipment on the basis that a good workman requires good tools. Except for an individual machine or two the writer knows of no place in the shop where a like expenditure would be likely to bring so great a return.

While this survey was conducted solely for the toolroom machines we likewise plan to carry out similar programs in all of the shops because we feel the results more than justify this work. We feel that the toolroom has more than kept pace with modern manufacturing demands and is now in a position to turn out complete and accurate tools required by our manufacturing department in the production of quality motor control apparatus which our company has manufactured for the past forty years.



Another recent addition particularly adapted to Cutler-Hammer's tool work is this special duplicator



After a complete survey of all toolroom equipment some machines were replaced while others, like the jig borer shown, were reconditioned

Cast-Iron Dies

CHESTER H. FRANKLIN

Ford is reported as indorsing the use of alloy cast iron for drawing dies on many parts, both large and small. The alloy is total carbon 3.25, silicon 1.25, manganese 0.45, nickel 2.00 and chromium 0.70 per cent. These dies are heated to 1,500 deg. F., quenched in oil, reheated to 900 deg. F. and cooled in air. This should give a hardness of 286-321 Brinell. The relatively low cost of the cast dies and the ability to fill out intricate and thin sections, together with the ease of machining, make it useful for many purposes. It has, of course, been customary to cast large dies and, when drawing points wear, to put in steel inserts. With this alloy it is found cheaper to cast new dies than to spend the time on putting in inserts. Where the dies are too large to heat treat the mixture is changed as follows: Total carbon 3.00, silicon 1.45, manganese 0.90, nickel 3.00 and chromium 0.90 per cent. Castings are allowed to cool completely in the mold and give a Brinell hardness of 280-300. Best results are secured in an electric furnace but very good die iron can be made in a cupola with reasonable care. While not quite so hard as the heat-treated alloy iron, this mix has been found to have excellent resistance to abrasion.

Body Die Materials

To simplify its die practice the Edward G. Budd Manufacturing Company has set up material standards with recommendations for typical applications

FOR USE on automobile bodies, punches and dies should be made of materials that strike a proper balance between longevity and economy. The finished tools must be tough enough and hard enough to withstand the shock and abrasion to which they are subjected in the press. At the same time, because of the highly competitive conditions in automobile manufacture, they must be produced at the lowest cost consistent with satisfactory results.

According to popular belief, practically all divisions of the automotive industry embody mass production to the *n*th degree. As a matter of fact the viewpoint depends entirely upon the basis of a comparison. Making automobile bodies is a high production job compared to the building of machine tools or the manufacture of most other kinds of capital equipment, but contrasted with many manufacturing jobs, the number of parts turned out by a given set of body dies is decidedly limited.

Assume for instance that 60,000 cars of a certain make are produced in a year and that they are offered in twelve body styles. This means an average of only 5,000 pieces from a set of dies and, for the less popular models, production will fall much below this figure. Other divisions of the metal-industry, especially those engaged in the manufacture of small metal parts, as for instance, roller skate wheels, deal in terms of hundreds of thousands and dwarf by comparison the output of automobile bodies.

When a die runs into many tons of metal, as many body dies do, it makes a great difference in cost whether plain cast iron or an expensive alloy is used. Intricate use of inserts and multiple parts are also costly. Accordingly, the trend in body die design has been toward simplicity by the exclusion of highly complex designs and combinations of materials.

In order to clarify the principles involved and to set up a guide for its own practice, the Edward G. Budd Manufacturing Company has standardized on die materials and on typical applications of these materials. These standards were drawn to cover the great bulk of dies made by this company and are flexible in that they permit exceptions for usual conditions. The tool designer is not rigidly bound by them in his choice of materials when in his judgment non-standard procedure is more desirable.

Standard Specifications

The Budd die standards have been confined to six types of materials—four for blanking and two for forming; specifications are given approximately because of variations in practice by different steel makers. Not only do amounts of alloying elements vary for different trade brands but even the kind of alloying element may be altered.

The general objective in the use of alloys is to induce the formation of carbides that will increase strength and promote resistance to wear. As this may be done by the use of a number of different alloys, a wide variation in mill practice is to be expected.

Budd uses the following general groups of materials for blanking:

Group I—High carbon, water-hardening steel, corresponding approximately to S.A.E. 1095 and having a composition of carbon 0.90-1.05; manganese 0.25-0.50; with phosphorus and sulphur less than 0.03. This steel has the advantage of being low in cost and readily weldable. Since it is not deep hardening the core is left tough when its surface is hardened which for many dies is advantageous. Its chief disadvantage is that it is susceptible to warpage and cracking during heat-treatment.

Group II—High manganese, oil-hardening steel having an analysis of about: carbon 0.90; manganese 1.25; tungsten 0.50; and vanadium 0.50. These last two elements are often varied and sometimes the vanadium is omitted. This steel is non-deforming, deep-hardening and highly resistant to abrasion. It may be ground more deeply without exposing soft spots than plain carbon steel can be. However, it costs considerable more than carbon steel and is more difficult to weld.

Group III—Air-hardening steel, having an approximate composition of: carbon 2.00; chromium 12.00; molybdenum 1.00; vanadium, 0.20; tungsten 0.70. This steel is expensive compared to carbon steel but is much less likely to crack or warp in hardening. In general, it has the advantages and disadvantages of Group II but may be used on even more complicated dies.

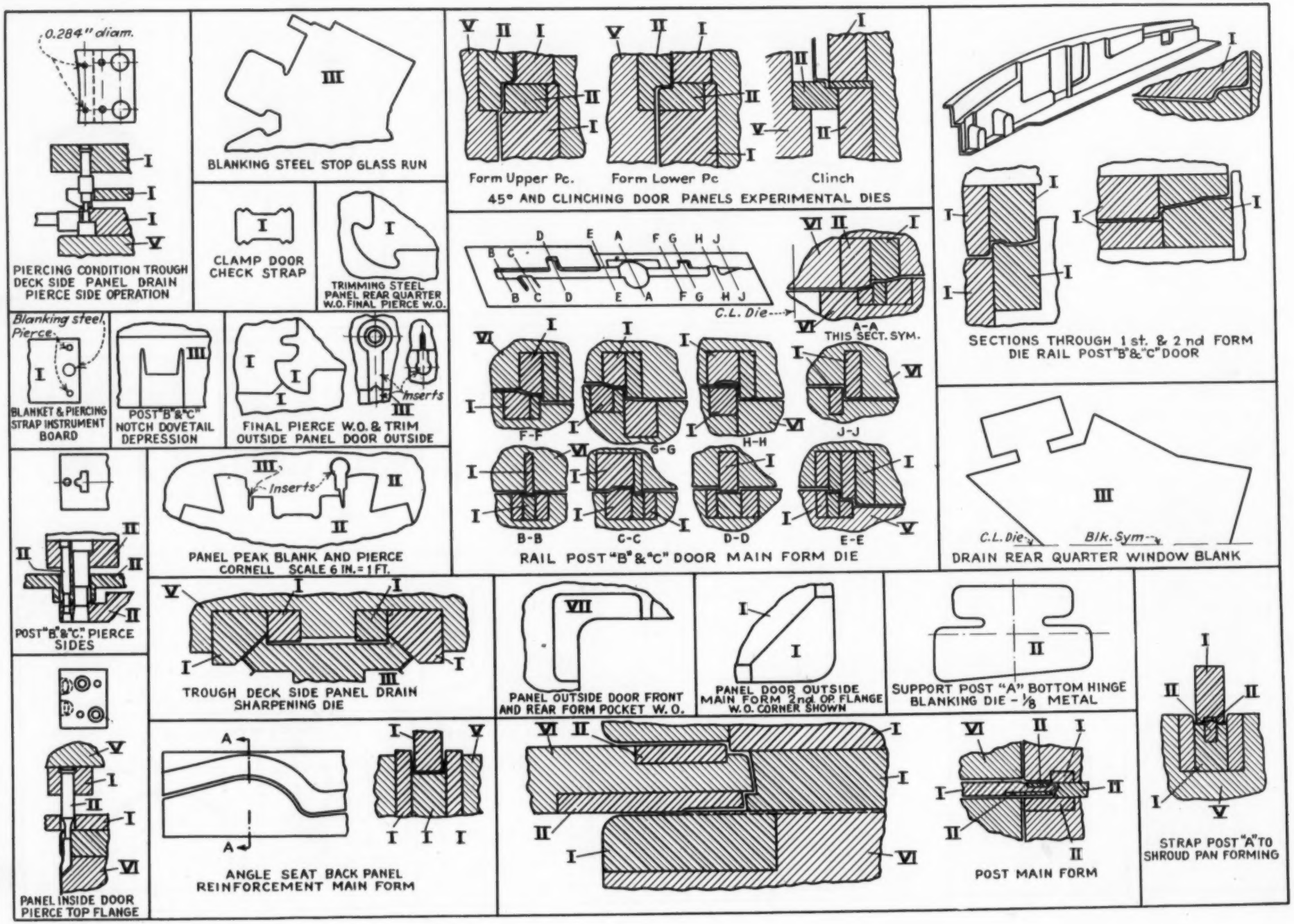
Group IV—Chrome-molybdenum castings which have an analysis of about: carbon 0.35-1.00; molybdenum 0.50; chromium 1.00; and may also contain about 0.15 of vanadium. This is an oil-hardening steel and is useful when the design makes it economical to cast.

For forming, cast iron is used almost entirely for the main portion of the die in the following general types.

Group V—Plain cast iron of about 40,000 lb. per sq.in. tensile strength, Brinell 225.

Group VI—Nickel-chrome cast iron, which usually contains these two elements in the ratio of three to one. While this material is a little more costly than plain cast iron it is stronger and more durable. Some typical compositions are tabulated on page 595.

BRACKET POST "B" BOTTOM MAIN FORMING DIE
REINF. SIDE PANEL LARGE FORMING DIE
SUPPORT-SPARE RIM BRACKET 1st. FORMING DIE
SHROUD PANEL HINGE CUTOUT DIE
SILL BODY SIDE FORMING DIE
POST FORMING DIE
BRACKET BODY FORMING DIE
PILLAR LOCK FRONT FORM
SILL CENTER CROSS REAR AND FRONT
POST "A" MAIN FORM DIE
SUPPORT POST INSIDE FORMING DIE
SILL BODY SIDE FORM
POST "A" MAIN FORM
FACING REAR DOOR HINGE PILLAR LOWER LEFT 1st. FORM
PUNCH FOR PIERCING HINGE SLOTS IN DOOR PANELS
STANDARD INSERTS FOR FLANGING DOOR CORNERS
BRACKET POST "A" BOTTOM 1st FORMING DIE
PANEL SHROUD 1st. FORMING DIE
BRACKET SILL CORNERS FORMING DIE
SUPPORT FRAME REAR SEAT CUSHION FORMING DIE
FACING DOOR LOCK PILLAR SHARPEN


0.284" diam.
PIERCING CONDITION TROUGH DECK SIDE PANEL DRAIN PIERCE SIDE OPERATION
BLANKING STEEL STOP GLASS RUN
CLAMP DOOR CHECK STRAP
TRIMMING STEEL PANEL REAR QUARTER W.O. FINAL PIERCE W.O.
Form Upper Pc.
Form Lower Pc
Clinch
45° AND CLINCHING DOOR PANELS EXPERIMENTAL DIES
SECTIONS THROUGH 1 st. & 2 nd FORM DIE RAIL POST "B" & "C" DOOR
Blanking steel
Pierce
BLANKET & PIERCING STRAP INSTRUMENT BOARD
POST "B" & "C" NOTCH DOVETAIL DEPRESSION
FINAL PIERCE W.O. & TRIM OUTSIDE PANEL DOOR OUTSIDE
Inserts
C.L. Die
A-A
THIS SECT. SYM.
F-F
G-G
H-H
J-J
B-B
C-C
D-D
E-E
RAIL POST "B" & "C" DOOR MAIN FORM DIE
DRAIN REAR QUARTER WINDOW BLANK
Blk. Sym
POST "B" & "C" PIERCE SIDES
PANEL PEAK BLANK AND PIERCE CORNELL SCALE 6 IN. = 1 FT.
TROUGH DECK SIDE PANEL DRAIN SHARPENING DIE
PANEL OUTSIDE DOOR FRONT AND REAR FORM POCKET W. O.
PANEL DOOR OUTSIDE MAIN FORM 2nd OP FLANGE W.O. CORNER SHOWN
SUPPORT POST "A" BOTTOM HINGE BLANKING DIE - 1/8 METAL
STRAP POST "A" TO SHROUD PAN FORMING
PANEL INSIDE DOOR PIERCE TOP FLANGE
ANGLE SEAT BACK PANEL REINFORCEMENT MAIN FORM
POST MAIN FORM

Nickel-Chromium Cast Irons

	Type 1	Type 2	Type 3	Type 4
Total carbon....	3.00 to 3.40%	3.00 to 3.40%	2.75 to 3.00%	3.00 to 3.40%
Manganese.....	0.60 0.90	0.60 0.90	0.60 0.90	0.60 0.90
Phosphorus....	under 0.30	under 0.30	under 0.30	under 0.30
Sulphur.....	under 0.12	under 0.12	under 0.12	under 0.12
Silicon.....	1.25 to 1.75	1.00 to 1.50	1.25 to 1.50	1.00 to 1.50
Nickel.....	1.25 1.75	2.50 3.00	1.50 2.00	5.50 6.00
Chromium.....	0.50 0.75	0.60 1.00	0.25 0.50	0.50 0.60

NOTE: Silicon and chromium should be varied according to the thickness of the dies. In very thick dies silicon should be on the low end of the range given in Table I and chromium on the high end of the given range.

The numbers on the accompanying charts refer to the material groups as described above. These charts were prepared by the Budd tool design department to suggest the material preferred for typical applications. The sketches represent die elements that frequently occur during the course of design rather than actual press tools.

In general the following heat-treatments are used for these standard materials. They are, however, subject to modification as steel makers, analyses deviate somewhat from the approximate standard compositions or as the size and shape of the dies make changes desirable. All temperatures are given in degrees Fahrenheit.

	Heat	Quench	Draw
Group I	1425–50	Water	400
Group II.....	1450–75	Oil	350–400
Group III....	1750	Air	900
Group IV....	1525	Oil	400

In heat-treating dies, the precautions usually employed to obtain good work are observed. Sharp corners are avoided in order to prevent breakage; plenty of quenching medium is available and under temperature control; furnace temperatures are accurately regulated and the dies are heated slowly and uniformly; a neutral or slightly reducing atmosphere prevents oxidation.

Gas-fired furnaces are employed for the larger heat-treating jobs. For small work the lead pot is used but care is taken that the lead does not become contaminated with copper which is used as a flash for laying out the dies.

For the blanking die materials given above, a final hardness of 60, Rockwell C scale, is desired. Groups V and VI, used for forming dies, are ordinarily used unheat-treated. For forming dies, however, where heavy draws or sharp bends impose severe service conditions, the cast iron is often supplemented by the use of inserts of harder materials. A typical example of this is the beads around the doors and body panels. For these inserts the blanking die materials specified in Groups I to IV are frequently used. Sometimes the high carbon steel of Group I unheat-treated will prove adequate. For high-production, small forming dies are sometimes made entirely from steel in Groups II and III.

These standards are used as a guide rather than as a definite restriction on the tool designer. In the past, many materials not included in these standards have been used, and some are still used when their particular properties are needed. Among these materials are Stellite, nitrided steel, chromium plate, and phosphor bronze.

Stellite is highly resistant to abrasion and often is a suitable material for inserts. Dies are frequently repaired by grinding and then welding with a Stellite rod.

Nitrided steel has excellent abrasion resistant properties but it takes long to heat-treat, but a die made from it is difficult to alter. Since many dies reach their final form empirically, several changes may be made before satisfactory results are obtained. Nitrided steel becomes soft when ground and consequently is not suitable when alterations are to be made. However, in replacing a die the shape of which has proved satisfactory, it may be used to advantage especially on deep drawn work.

Chromium plate gives die surfaces a high surface wear resistance but does not add to their strength. It has the property of adding slipperiness to the surface which allows the work material to be more easily drawn over it under the action of the press. It is particularly advantageous for stainless steel stampings.

Hard bronzes are used as inserts to prevent cold welding of the die and the work stock which occurs in some cases when steel is employed for both. While some hardness is sacrificed by the use of bronze, this material permits the stock to slide over it freely, preventing pick-up and scoring.

As a result of its standardization, the Budd company has succeeded in reducing the number of die materials in use and in establishing practice found satisfactory from past experience. The net gain has been a saving in die costs.

Shrink-Fit Assemblies

JOHN E. HYLER

Most of us are well aware that close temperature control is important in our shrink-fit assemblies and that the modern electric furnace with automatic control is a mighty good bet along this particular line. But there are many of us who have not given as much thought as we should to the elapsed-time factor in such work, especially in the assembly of threaded parts.

Taking as a case in point the assembly of threaded steel cylinders to heated, duralumin airplane motor heads, when one considers the matter he sees at once that the most auspicious time to get the cylinder into place is immediately upon withdrawal of the head from the furnace. The cylinder must be started and run all the way in to its seat as quickly as possible for best results, since both parts tend toward a heat balance as soon as contact is made, the cylinder rising in temperature and the head dropping.

A good means of having the head ready for immediate assembly when withdrawn from the furnace is to have it rigidly mounted on a work fixture, and the fixture slidably mounted on a track extending from the furnace interior onto a work table located right in front of the furnace. Thus, the head is rigidly held at once upon withdrawal, and the cylinder may be screwed directly and downwardly into place without loss of time.

A Chuck-Tightening Indicator—Discussion

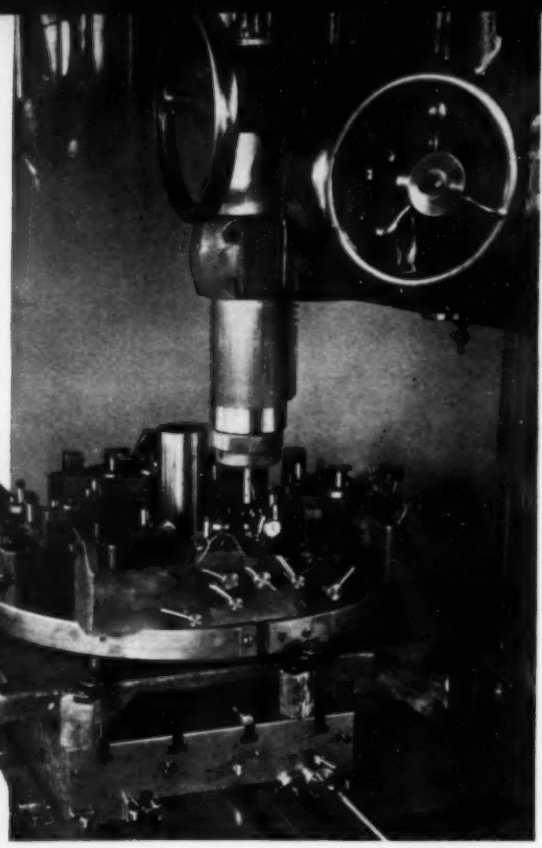
J. T. TOWLSON
London, England

Referring to the article by N. M. Moore under the title given above (*AM*—Vol. 78, page 389), I cannot understand how work released from an independent chuck can be rechucked to run true by the device described. I am wondering how near approach to accuracy Mr. Moore implies by the term "true." Perhaps he means true enough for his needs and for the job he has in mind.

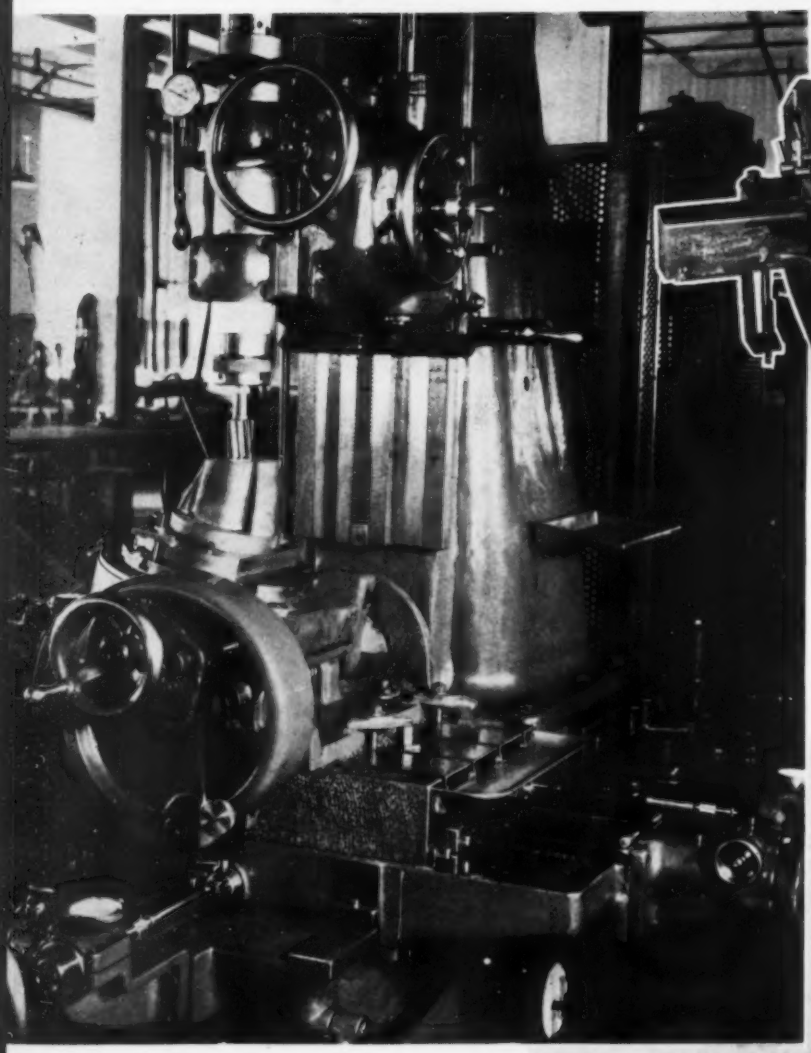
Work concentric and eccentric that is required to run true, not only on the diameter but on the face as well; work large in diameter and held by a part that is less in diameter, would appear to militate against full dependency upon Mr. Moore's device. In using this device, I would never be satisfied that the work was set to run true until I had applied the indicator to it.

Jigs

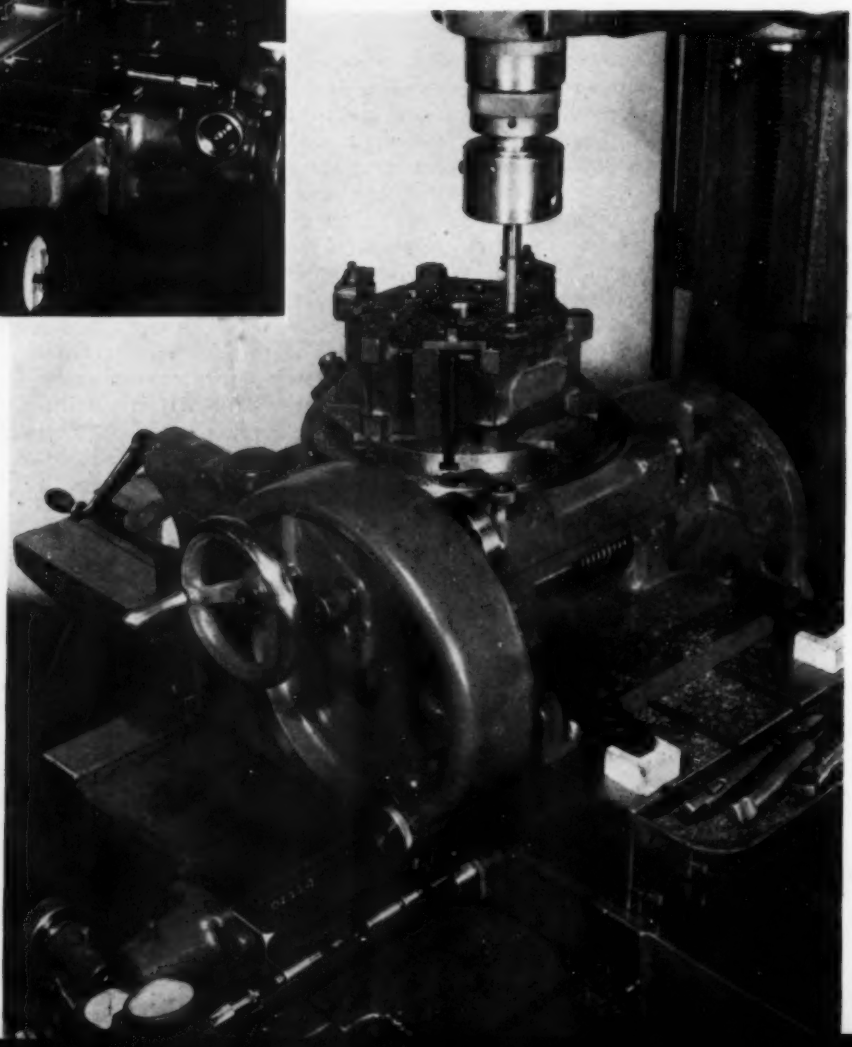
From Jig Borers



Here the P. & W. jig borer is shown as an assembly means for putting together a four-station fixture for a milling machine. The various small parts are accurately located by means of jig borer measuring instruments and are then pinned in place, using the machine to drill the holes



me difficult angles on this st-iron fixture were ma- ined by use of a tilting tary table. The top face s milled at the correct an- e, and a hole was drilled rough the body of the fix- re at an odd angle with another hole

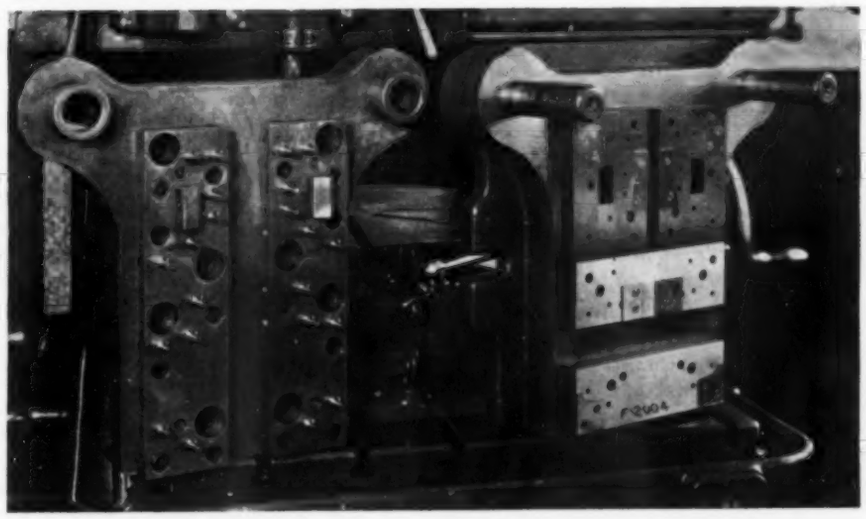


After the vertical holes are bored the table is tilted and indexed to machine holes in the bosses at the side of the jig. In the foreground the internal micrometer and dial indicator used for locating the table may be seen

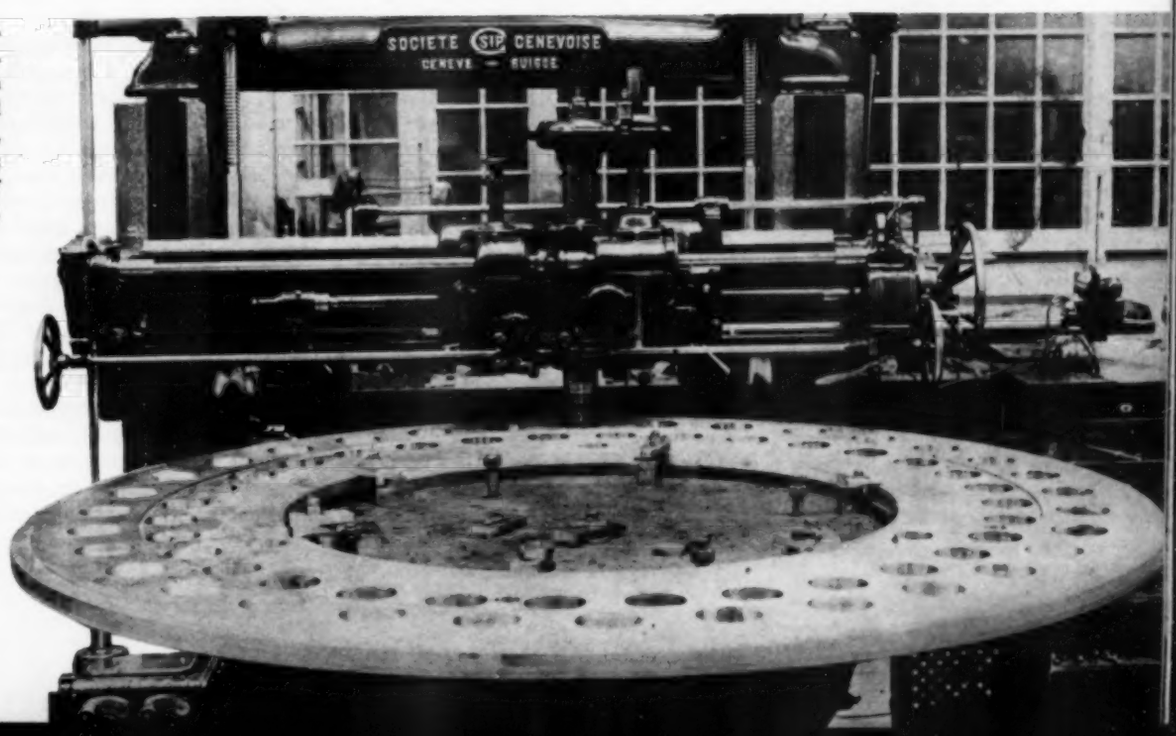
Heavy work, too, may be handled on the jig borer. The illustration shows a 1,500-lb. jig for a power shovel turntable being bored on a No. 6 Société Genevoise machine

The two halves of this die involve the accurate location of 22 holes in each part; this work was done in 3½ hr. in a Société Genevoise jig borer

Toolroom layouts were long and tedious when complete reliance was based on the chalk mark and scriber. Now with the jig borer available, holes and angles are located on the machine



Sixty-four 4½-in. and four 1¼-in. holes were bored in this large steel drill jig, 2¼ in. thick, within 0.002 in.; the pitch circle of the outer holes is 94 in. in diameter



The Special Tool, Die and Machine Shop Institute—Where Is It Going?

J. J. KOHL
President

Scarcely a year old, the Special Tool, Die & Machine Shop Institute has already justified the faith of its organizers. Even so, its big job is ahead of it, as is made clear by President Kohl's article

THE SPECIAL TOOL, DIE & MACHINE SHOP INSTITUTE is the official trade association for manufacturers engaged in operating jobbing machine shops and plants designing and building, for sale, jigs, fixtures, dies, gages and certain types and kinds of special machinery.

The industry which the Institute represents is a bit unique. It embraces a great number of comparatively small individual units—small in size and scope of operation—yet having substantial investments in the form of mechanical equipment. Activities of the industry are carried on in every section of the country. There is hardly a town or city of any consequence which does not include among its businesses some shop belonging in this classification.

The fundamental peculiarities, together with the class of labor employed, which is almost wholly of a highly skilled character, and the close relationship to other mechanical manufacturing plants embracing the largest in the world, give rise to problems and situations that are somewhat difficult of solution and will require patient application and much serious effort before real progress can be made toward higher ethical, business, and technical standards. This, then, is the task of the Institute—to solve the problems and eliminate, or at least mitigate, the undesirable conditions.

It is my purpose to outline some of the practices and conditions causing the greatest hardships in the industry and doing the most harm, and to indicate as best I may at this time what can be done about them.

Before doing this, however, it might be interesting to pause for just a moment to inquire just why there is such a thing as the special tool, die and machine shop industry. Is there a real justification for its existence? Does it perform a useful economic function?

The answer is most emphatically "Yes"—more so than is readily apparent on the surface. The industry does perform a useful economic function and will for many years more have ample justification for its existence.

For thirty years or more, starting with the small "back-alley" machine shop and culminating with present day tool shops, some employing 1,000 men, the number of these units has constantly increased, which in itself indicates, in no small degree, the usefulness of these shops to industry at large. Specifically, however, there are many other reasons.

Inventor's Salvation

The promoter and inventor—almost always possessing extremely limited capital—had found, and still finds, the small shop his salvation. The record of our mechanical development is alive with references to the work carried on in such places. The mechanical training of our best craftsmen and the ingenuity they have displayed in their handiwork is a tribute to the usefulness of these shops. They have been the cradle of many of our modern appliances and inventions. They have been the boon of the manufacturer of mechanical products needing extraordinary help in emergencies or at intervals of excess business demand.

In these later days the set-up of the larger units embraces the latest in mechanical equipment, personnel and business practices. The general business technique will compare favorably with that employed in our most progressive major industries, although it is only fair to point out that many of the smaller units still have room for improvement.

The modern set-up, then, still offers expert technical and mechanical facilities and services for almost any demand, be it expressed in hundreds of dollars or millions, be it of extreme accuracy or just of plain machinist variety, be it a matter of tons or ounces. It still retains its "pinch-hitting" and "overflow absorbing" characteristics. The shops in our industry still serve the major industries and hundreds of smaller manufacturers by doing for them the things which they cannot do for themselves except at great economic expense or prohibitive delay. In other words, the basic function is still the same as it was in earlier years.

Experimenting Less Important

There has, however, been somewhat of a shifting of values. Less importance is now attached to the expert mechanical service function of the jobbing machine or tool shop than heretofore. Standard product manufacturers, for obvious reasons of secrecy and other considerations, do their own experimental and research work, spreading it throughout the year and therefore relying less upon the outside source.

Much more importance attaches to this industry as—shall we say—an "investment saver." I venture the thought that if this function of the industry were better understood, and given more serious consideration, there would be less expansion of so-called divisional toolroom and machine shop facilities in some of the country's large plants manufacturing mechanical products, notably automobiles, tractors, refrigerators, motors, calculating machines, radios, washing machines, toys, electrical appliances, and hundreds of other products.

I am quite sure that it would have been a considerable comfort during the last four years to managers, owners and boards of directors in many corporations and firms if their investment in toolroom equipment and the necessary housing and personnel to maintain it had been very much less, or better yet, nonexistent entirely. The staggering cost of constantly increasing charges for depreciation, obsolescence, interest, watching, maintenance, insurance, salaries and

numerous other items, entailed by a set-up that for the most part stood idle, and at best was never really productive, would have been avoided.

In order to make this function a bit more clear, let us suppose that the special tool, die and machine shop industry were suddenly wiped from the face of the earth—not a jobbing machine shop or an independent tool shop available anywhere. What would happen?

Manufacturer *A* making, let us say, electric refrigerators must put into production his entirely new model to rehabilitate his sales position in the field. He has no toolroom facilities, except perhaps a small force for ordinary maintenance. He wants his tools and dies completed in six weeks. He finds that the new tools he will need will require approximately 24,000 hrs. of toolroom work, or an average of about 100 men for six weeks, which would mean about 150 men for several weeks, the requirements for men building up toward a peak and tapering back down again as the program ends. The following are some of the things Manufacturer *A* must do and do quickly:

Engage executive personnel;

Engage tool designers and tool and die makers;

Purchase equipment for a tool shop of 150 men, costing perhaps $100,000;

Rent, lease or build housing for the equipment;

Expand clerical and office force;

Provide additional cash for a payroll of about $15,000 per month;

Arrange for a thousand and one other matters, all costing some money and all necessary to the expansion of plant facilities or the starting of a new business.

Delays and Errors

After he has the set-up his troubles are not over yet. The newness of the set-up causes delays, errors and displacements. Finally, he will have his tooling completed in eight or ten weeks instead of six weeks. The men are laid off but some of the executive personnel may be retained, at least temporarily. Now he has no further need for his $100,000 toolroom set-up—may not need it again for a year, or perhaps, as in the case of a declining business cycle when new models may not be in order, may not again have need for such a tool set-up for many years. What then? It stands idle, accumulating all sorts of charges for maintenance, taxes, insurance and sometimes salaried personnel. The forces of deterioration start getting in their deadly work.

Soon Manufacturer *B* also decides to retool to bring down his production costs. His electric refrigerator may still be quite up to date in design, but his manufacturing methods may be obsolete. He may need more volume to reduce costs so he can meet competition.

In contract tool and die shops like this one much of the accurate tool work of industry is done by skilled toolmakers

Then he, too, sets up a $100,000 outfit to be used for two or three months and then stand idle. Manufacturer *B* would probably hesitate to approach Manufacturer *A* about his idle plant, even if he knew about it, and Manufacturer *A* would probably decline to let *B* have his toolroom facilities except at a prohibitive cost. Otherwise *B* would derive an advantage over *A*. So both would end up with frozen investments to the tune of several hundred thousands of dollars in idle toolroom facilities.

Then Manufacturers *C*, *D*, *E*, *F*, *G*, and *H*, in succession, retool to meet the improvements of the others, and in turn, during a year or so, establish $100,000 toolrooms until there has been brought into existence a combined toolroom plant costing close to a million dollars, used for an average of eight or ten weeks, then idle but constantly costing money.

Variations might be introduced to suit other lines of manufacture and other circumstances, but the illustration will hold good, to a greater or lesser extent, throughout the entire list of mechanical manufacturing industries.

A Staggering Contrast

If we now bring back again the tool, die and jobbing machine shops, as they exist today, the contrast is rather staggering. Manufacturer *A* does *not* establish his own toolroom by spending $100,000 or more. He delegates a few well qualified individuals out of his own organization to supervise the new tooling, investigates two or three outside tool shops with proper facilities and personnel and sufficient capacity to deliver his tooling in the six weeks. When he is all through, and if he has planned well and used good judgment, it is almost a certainty that he has bought his tools for less actual outlay of money—if all factors are properly evaluated and *all* costs properly allocated. He still has his $100,000 or more, which he didn't need to spend for toolroom facilities and which he can apply to great advantage in sales promotion work, or in some other direction, and he has evaded the constant drain of ever-present charges for carrying an inactive department.

The Net Result

Manufacturers *B*, *C*, *D*, *E*, *F*, *G*, and *H*, in turn, also use outside sources, perhaps even the same tool sources in succession at various times throughout the year. Net result—one or two independent toolroom set-ups with an investment of $100,000 to $200,000, busy all year, will do the same work as the eight private toolrooms with an investment of nearly a million dollars. In actual practice the outside shops apply themselves to the tooling programs of different industries at different times of the year, rather than to units of the same industry at different times of the year.

The so-called jobbing machine shop performs substantially the same type of service, but more along machine repair and emergency lines where there are no divisional machine shops for maintenance or repair purposes, or where such facilities are not extensive or versatile enough to do the work quickly and efficiently. Often the jobbing machine shops in our industry cater to specific major industries exclusively, such as ship building, textile, paper making, oil well, and numerous others.

It is occasionally said that there has been over expansion of the special tool, die and machine shop industry. I think this is distinctly not true. The over expansion, if there has been any, has been in the divisional tool and machine shops. In case my reference to divisional

shops is not clear, I might explain that the divisional shop is a department operated as an auxiliary or a service section of a larger manufacturing establishment making other products and deriving its income from the sale thereof, and not from the sale of tools, dies, etc., or other mechanical jobbing work. In other words, the divisional shop, described at one time as a "necessary evil," makes tools and dies for its own use only, and not for sale to others.

Excess Capacity

This excess of capacity in the divisional shops did a great deal of damage during the recent depression. Because of the fixed charges entailed in having such large and expensive divisional shops, the divisional shops in many localities invaded the field of the outside tool manufacturers and machine shops. In most cases that have been revealed, the work was taken at prices that could not have permitted very much more than the payment of the direct labor costs. It is questionable if these arrangements were ever satisfactory to either party to the contract. Circumstantial evidence and other word of mouth information indicates very strongly that the results of these efforts were quite unsatisfactory, a result easily understandable, since it requires a very different method of approach to build tools for outside interests as distinguished from making them for your own plant and use. This may not be apparent, but practical experience has proved this contention many times.

The essential consideration of this situation is that the over expansion of the divisional shops has not only been a distinct burden to the parent manufacturer, but has been a decidedly detrimental influence in the conduct of the independent tool, die and machine jobbing field, during the stress period, robbing the industry of business it sorely needed.

This industry makes one further claim in support of its existence. It strongly contends that it can build tools, dies, etc., do repair and experimental work at a lesser cost than divisional organizations. I can immediately hear a chorus of opposite opinions, yet the fact remains that there are any number of manufacturers who freely admit that they are better off in buying their requirements in this line rather than equipping to do it themselves, always, of course, excepting the necessary facilities for normal maintenance.

There is, however, quite a difference of opinion on the subject, not among the independent operators, but among those responsible for the operation and maintenance of divisional departments as part of their plants. The reason for the difference of opinion lies in the lack of uniformity in accounting methods, particularly in costing and allocation of charges.

There is a tremendous opportunity to clarify this subject, if the industries most interested would support a commission or committee to make a comprehensive and disinterested survey. An expert acountant, an economist, a member of the Special Tool, Die & Machine Shop Institute, and a member from the manufacturing industries generally, should compose such a committee. The value of the good such a study could do would many times exceed its possible cost.

Occasionally the statement is heard that satisfactory service and quality cannot be obtained from outside sources. Where such an experience has prevailed, there can usually be found a lack of proper and reasonable cooperation and coordination. There must be intelligent direction of the work to be done outside, a little planning to tie in the various activities, proper selection of sources, and a clear understanding of objectives to be attained. Reasonable foresight and cooperation will make much difference in the results obtained.

In the outline given above it must be understood that the presentation is intended to be representative of conditions generally, but not necessarily universal. It is quite well known that there are divisional toolrooms and machine shops who do their particular type of work at an unusually low cost which no outside source could hope to equal. Such instances, however, are extremely rare and in every case it will be found that the sort of work done has been highly specialized, is repetitive, and that the shop employs a technique in carrying out the work which is the result of years of constant improvement, experiment and education. Such places obtain their favorable cost, not so much by reason of the efficiency in functional performance but by reason of the inherent nature of the work.

Work of the Institute

Having now given an outline of general functions of the industry we pass on to a consideration of the major problems and needs. It is the work of the Institute to endeavor to bring about a better understanding of the work done by the members of this industry, particularly in relation to the subjects covered in the preceding paragraphs. There are, however, other most important considerations which need urgent attention. They refer to three chief divisions: relations between members; industrial relations; and customer relations.

In the field of relations between members there is no subject of greater importance than that of below cost selling. Much misinformation exists on this subject tending to create distrust and suspicion among members. Happily, the Institute has already made rather worth while strides in breaking down this tendency. The desire to get at the truth in the matter of costs, selling prices, service arrangements, terms and kindred items, has stimulated association activities, not only nationally but in many individual localities. Ethical considerations as between members are being more and more respected, and sympathetic cooperation is beginning to take the place of distrust.

Costing Methods

Fundamentally, however, it is of the utmost importance that the Institute and all of its subdivisions foster and prosecute intensive study of proper costing methods. Our smaller units particularly must give special consideration to this study. The tendency to overlook hidden costs and to trust to luck that a profit will ensue is rampant in the small shop. where expert mechanical ability abounds but business acumen is often totally lacking. There must be built up a thorough appreciation of the hidden costs so that these costs, as well as those incurred directly, will not be overlooked in the pricing structure. Once a proper understanding becomes a matter of common knowledge throughout the industry, there then still remains a need for building up moral courage to resist all the various influences calculated to encourage below cost selling.

In other words, it is not enough to cost properly if such costing does not form the basis for proper selling prices. In connection with costing there should be an improvement in estimating practice. Careless or snap judgment estimating of labor and material items does a great deal more damage than is commonly believed. In the estimating procedure elements of risk must be properly evaluated and reflected in the price. Safety factors should be provided whenever there are elements in the work to be undertaken which cannot be estimated with reasonable accuracy, and excessive uncertainty or risk should be done on a time and material basis. Adequate profit margins have never been possible in selling price to permit the assuming of extensive risks of a development or experimental nature. It is, therefore, grossly unfair, and almost suicidal, for the shop owner to quote a fixed price on such work. Arrangements for handling such work can and have been worked out that safeguard the interests of both buyer and seller, yet im-

pose no inequitable condition on either.

In general, the promotion of educational programs, as among members particularly, but also in the field of customer relations and employee relations, will perhaps be the most profitable Institute activity.

Price fixing, generally, should be discouraged as a demoralizing influence. Price fixing, to the extent that it means pricing according to a formula and binding all members of the industry alike, not only subdues individual initiative and ambition, but directly encourages inefficiency and support of the unfit. Without ambition and initiative there would be very little progress. Collusion and dishonesty must be weeded out and business encouraged that is based on merit. Honesty in pricing demands that the price be based on actual costs—all costs—plus a reasonable profit for the service conscientiously rendered.

Industrial Relations

Industrial relations as they apply to employee interests need more sympathetic and equitable consideration. The average American skilled mechanic has suffered much in recent years, both in loss of wages and in peace of mind. He has been driven into other fields and is reluctant to return to the uncertainty which he has experienced. There is, therefore, an obligation that should be taken seriously by every shop owner and executive engaged in the industry, as well as by the Institute, to improve the existing circumstances.

Stabilization of employment stands, perhaps, as the major objective. Stabilization of wage rates to prevent the extreme fluctuations comes next. Working at the trade should be made attractive. Steps should be taken to develop a comprehensive apprentice system. Merit rating formulas or some promotional scheme could profitably be worked out to provide constant incentive for improvement in mechanical ability. These and many other similar activities of minor nature would unquestionably constitute a potent force to offset the efforts of extremist agitators who sow unrest and radicalism among the rank and file of the skilled workers.

There are many instances of customer relations that have endured for years, based on the principle of mutual usefulness in a service fairly rendered and fairly received. Unfortunately, such pleasant relations do not exist everywhere. In every business and industry there are racketeers, both among buyers and sellers. Unscrupulous buyers will apply competitive pressure to drive down prices, occasionally by deliberate misrepresentation, without the least consideration of common decency or justice. Sellers, on the other hand, among members of our industry exist here and there who encourage and become parties to dishonesty, collusion and bribery. Needless to say, the legitimate operator in the industry deplores such conditions and makes what effort he can to eliminate them. His efforts, however, are seldom effective. The elimination of racketeering in any industry or business must be accomplished by collective action.

The Special Tool, Die & Machine Shop Institute, therefore, has a responsibility in this field which it can well afford to take seriously. It is, of course, true that the great majority of members of the Institute, and a great preponderance of the customers whose work they do, are persons of unquestioned integrity. Nevertheless, the existence of even a very small percentage of dishonest individuals casts a shadow upon the industry at large, and creates a certain measure of distrust of the members generally.

In the case of customer relations I believe the Institute can be of less assistance than the individual owners of shops themselves. The economics of jobbing shop operations are not very well understood by those in customers' organizations who have direct contact with the concerns in our industry. It is essential that toolshop owners and their representatives should fortify themselves with all the salient facts in connection with the operation of their business, and have these facts at their fingertips for use upon every occasion where presentation of the information will result in a better understanding.

Reasonable Profit

The industry is entitled to a reasonable profit. If I were asked to define a reasonable profit, I would say that the profit should be equal to not less than 10 per cent per annum on the value of the investment in each individual business. This 10 per cent profit must, however, be absolutely clear and above all direct and indirect costs of doing business. In addition it should be so distributed as to equal 10 per cent in *every* year. Inasmuch as there are lean years and good years, and usually more lean years than good years, it might be necessary to earn 30 per cent or 40 per cent during the good years, in order to compensate for the lack of profit or actual loss of capital in lean years.

There are those who would say that 10 per cent is not enough to compensate for the risk and effort required. Be that as it may, the fact remains that 10 per cent net of all salaries and overhead, earned every year, would be so much better than the experience which has prevailed in the last four years or even over an average of ten years, that it should be highly satisfactory. The right to a profit is one which is still well recognized in this country and therefore is not to be given up lightly. Yet there are those who have in recent years developed an inferiority complex and a low price complex that is little less than criminal, and has caused them not only to forego a profit, but in many cases actually to donate resources for the questionable privilege of turning out an order. It has demoralized the entire value structure so that there is no longer a standard of what constitutes the right price. It is purely a state of mind, and could easily be dispelled by examining the facts and figures presented in any company's books.

The Institute must bring to its members a courage and feeling of confidence to go out and present the facts so that there will be a greater recognition of the service rendered by the industry among the customers. The right to a legitimate profit must be upheld. This must not be done by misleading propaganda or misrepresentation, but must be founded fairly and squarely upon sound business procedure and accurate costs.

Among customers it seems to be a sort of standing assumption that in a series of quotations the high figure is out of line. It is high time that the fallacy of this assumption be exposed. Evidence as brought out by surveys and other investigations indicates overwhelmingly that the higher quotation usually represents the right price, and that the low bidder is almost invariably the one who has made a serious error in his estimate of costs and profit, or is making an unjustified concession to gain an advantage over a competitor.

Conclusion

"Where Is The Institute Going?" The above indicates the general direction and the desirable goals—goals that will not be attained overnight, of course, but possible of attainment with patience, perseverance, and the serious-minded cooperation of every one concerned.

An earnest and outstanding Board of Trustees of the Institute and a most capable and energetic Managing Director are providing the Institute with effective generalship. It is striving for a firm foundation on which to build permanent improvement rather than attempt to attain quick temporary adjustments that would prove of little lasting benefit.

To the world at large, and to the members of the industry, the Institute pledges its constant efforts towards high standards and more worth while relationships.

Special Tool, Die and Machine Shops Under the NRA Code

ROY T. WISE
Executive Secretary,
Special Tool, Die & Machine Shop Industry Code Authority

THE IMPORTANCE of the Tool, Die and Machine Shop Industry has been brought forcibly to the attention of the consumers of its products since the advent of the National Industrial Recovery Act. In a preceding article J. J. Kohl has explained very clearly the economic justification for the industry.

Until the Industry was organized in a national institute the special tool, die and machine shops scattered over the country could not claim recognition by NRA. Today they have a Code, which means a chance to obtain the benefits of cooperation, planing and fair trade practices under the terms of the NIRA.

The Code Authority is the industry's board of directors, the legal entity under which the industry can plan its operations in the future without fear that by some unwitting action it will run afoul of the anti-trust laws. For the first time, therefore, this unorganized industry can look ahead, confident of greater strength in voluntary unification.

Before joining the NRA this vast number of small shops took care of themselves as best they could. They kept books to show profit and loss but they could not stabilize their operations. Now they are in a position to build on a firm foundation, to eliminate sharp practices, to keep tab on their business as a whole.

A Regional Set-Up

In times past, there was nothing that an individual shop could do to protect itself from the peaks and valleys of business. Now the industry can have many things that before were beyond its reach. Not, of course, inflexible rules applied alike to shops in Maine and Montana, but regional adjustments to meet varying conditions as to prices and practices. New England will have no reason, for instance, to feel that it is oppressed by conditions in other sections.

The organization of the industry is set up on the principles of self-government. The By-Laws of the Code Authority are necessary simply to establish the responsibility of its officers, and to set down the guides showing whether or not plans proposed for stabilizing the industry are legal. There will be no interference by the Government with the industry's management.

NRA welcomed the efforts of the Institute to organize the jobbing tool, die and machine shops. It regards the Code that has grown out of this organization as the normal place for such shops under NRA, at least until they become specialists in any particular line which logically would bring them under other Codes; textile machinery, for example. It believes also that a healthful economic effect will result from the organization of the jobbing shops. With their operations stabilized, they will absorb more effectively the peaks in specialized industries and operate more economically than divisional tool shops in periods of lean business.

Brought into being by a group of men eager to take advantage of the opportunities offered by NIRA, the Institute is a voluntary organization of the members of the industry banded together for joint action. Without the Institute, this industry probably would have been absorbed in some other Code and ruled by the Code Authority of a larger and disinterested industry.

The industry's Code Authority is primarily a part of its own Institute. In obtaining a Code and electing a Code Authority, the Institute has complied with all the requirements of NIRA. The Code Authority includes equitable representation of large and small shops.

Its administration member, Major W. H. Crom, is well qualified to represent NRA. He is a man of large experience and sympathetic understanding, and has a real working knowledge of the industry. He attends all of the meetings held by the Code Authority and it is a part of his duty to see that there are no inequitable restrictions placed upon members of the industry, and that each and every one of them gets a square deal. He has no personal prejudices or commitments and brings to the Code Authority the Administration's policy.

The functions of the Code Authority do not extend beyond the scope of the Code, as approved by President Roosevelt. Its principal job is to plan for the industry, insure equitable administration and compliance with Code provisions. The Code Authority utilizes the facilities and personnel of the Institute. The funds collected by the Code Authority are used to pay the expense of all activities, engaged in solely for the benefit of the Industry as a whole, and therefore, of benefit to individual members.

Experience has clearly indicated that in those districts where the industry is well organized into local divisions of the Institute, violation of Code provisions and abuses formerly prevalent in the industry are reduced to a bare minimum. It should be obvious to everyone that the more effectively the industry is organized into local divisions of the Institute the more effective will be the work of its national office and the Code Authority. It is certain, too, that this industry will grow in importance to the industrial life of our nation in direct proportion to the development of the individual members, groups of members, and their organization.

Employee Relations Improved

The whole program is a sound and sensible one that provides for taking full advantage of the opportunities made possible by the National Industrial Recovery Act, and the Code obtained is looked upon as one of the best among those for metal-working industries. The Institute has set up the facilities and personnel for administering the Code. It has assisted in the organization of local divisions of the Institute, and has brought them up to a standard where some of them are now charging initiation fees for local membership. A better understanding of industrial relations between employer and employee has been established and much information of inestimable value to the members has been obtained.

Contact has been maintained by the Institute with official Washington on Reconstruction Finance Corporation loans to the industry, and this information has been sent to members through local divisions. The national office has cooperated with divisions of the Industry in the establishment of minimum billing rates for trade areas, and has brought about an understanding between members in these areas that has eliminated to a great extent cut-throat competition, and is making it possible for them to make a profit.

Good Will Through Publicity

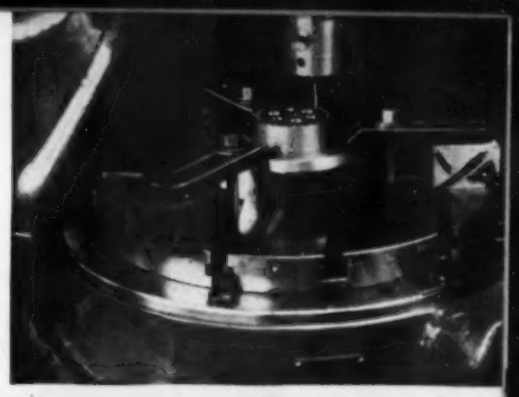
Consumer appreciation for the industry has been built up by paid advertising and publicity in prominent trade journals. Ceaseless war has been waged against legislation unfavorable to the industry. The Institute's value to the individual member and groups of members depends upon the use made of it by such members or groups of members. For instance, many members of the industry are using a seal identifying them with the local division affiliated with the national Institute.

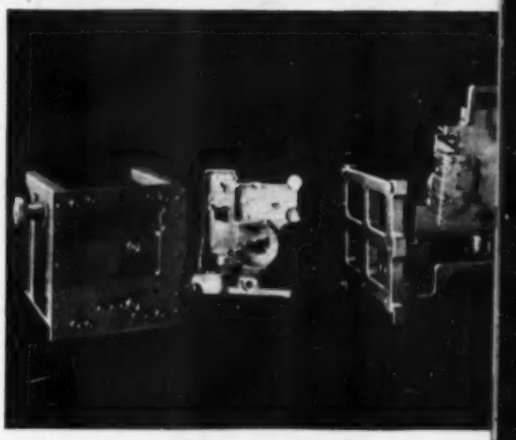
The Code Authority's responsibility extends to all members of the industry, and it must administer the provisions of the Code in an impartial manner. It is necessary for it to keep in constant contact with the Administration in Washington in order to obtain maximum benefits for the Industry from the NRA program as it develops. To this end its staff is being extended as rapidly as funds are available.

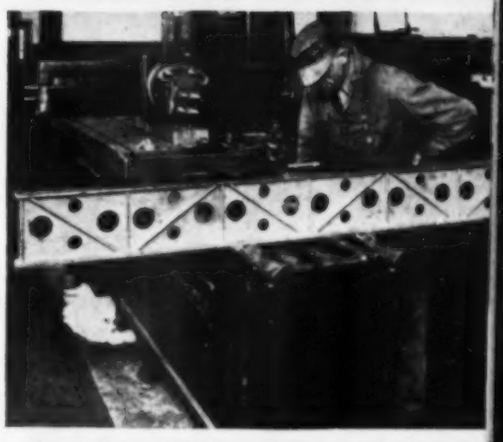
Administrative regulations for the effective handling of trade practice complaints have been aproved by the Administration. Assistant secretaries have been appointed in districts where funds have been available to meet their expenses. Code eagles have been mailed from the Code Authority's office to members who have paid their assessments. They can be obtained only from that office, and only upon compliance with the Code and payment of the Code Authority assessment.

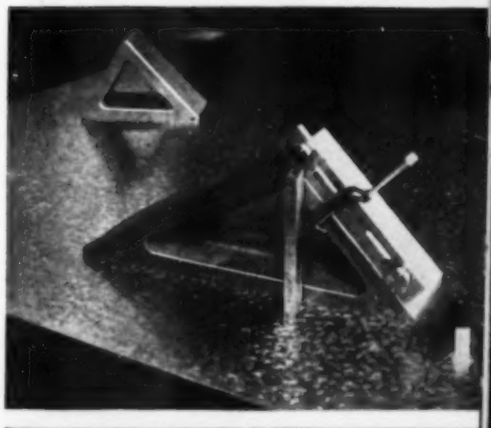
The Institute and the Code Authority are ever alert to possibilities for the industry's development. Constructive comments and ideas will be most welcome at all times, as well as questions concerning administration of the Code. It is the duty of every member of the industry to report Code violations to the Code Authority for prosecution in accordance with the Act.

In its program for codifying of all industries that did not have an approved code, NRA has recently directed several related industries to operate under the approved Code for this industry. Steps are being taken to coordinate these groups with the industry, the Code Authority having voted its approval of the NRA action.



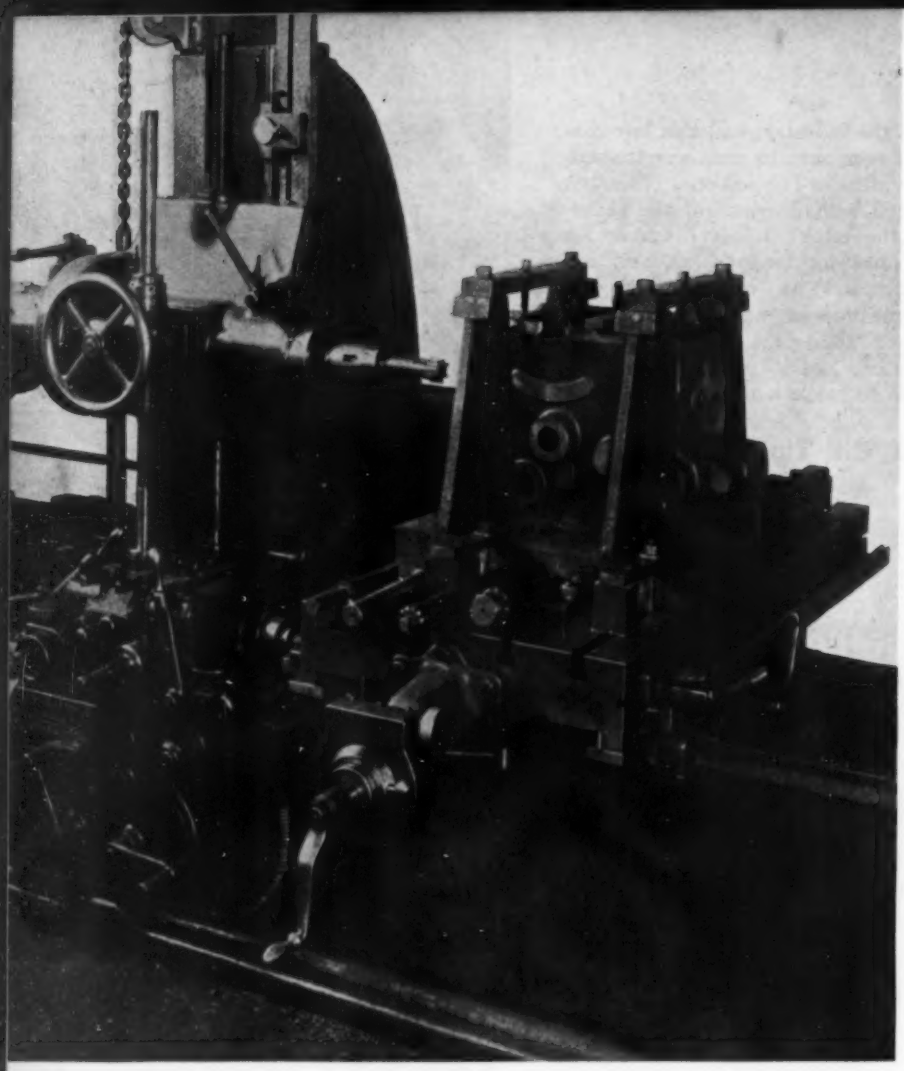




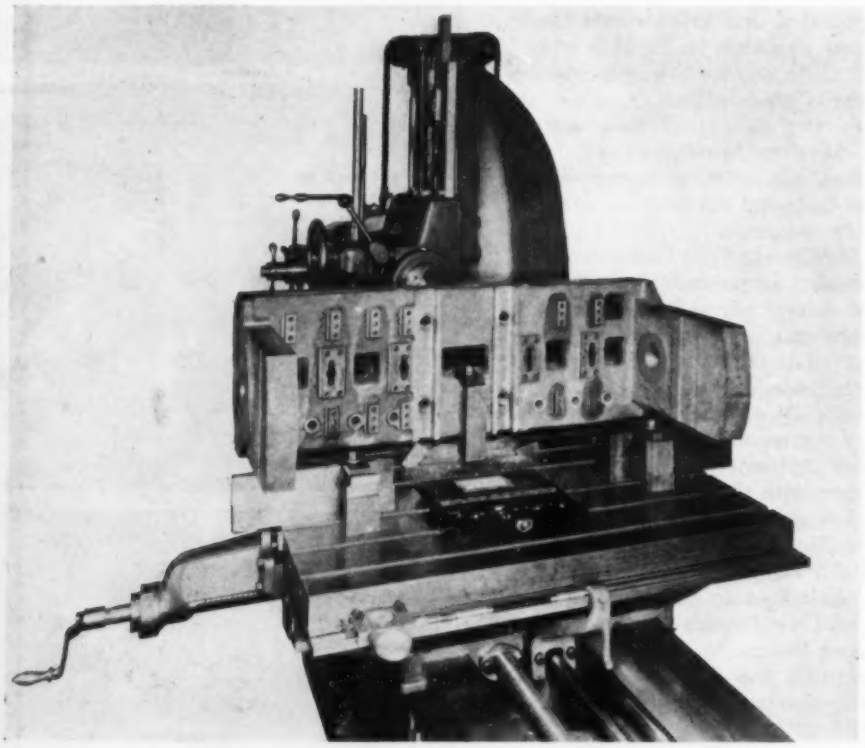


Horizontal

Precision in laying out and machining work horizontally is reflected in applications of the Lucas boring, drilling and milling machine



A reversible fixture is used to bore this lathe apron using the indexing device. A test with an arbor fitted snugly into holes bored from opposite ends affirms the accuracy of this method



This is the cradle member of a jig which holds an eight-cylinder motor block. On the table may be seen a case of standard end measures

WHILE the vertical jig borer is usually suitable on comparatively flat work there is a range of toolroom boring for which horizontal operation may be advantageous. The horizontal boring, drilling and milling machine is often found useful for machining deep box jigs and other large work without introducing the difficulty of the operator's reaching over the work to adjust tools and to observe the cuts.

In order that dependence need not be placed on maintenance of truth of pitch of the traverse screws, which may wear unevenly if used for milling, the horizontal machine may be equipped with a dial indicator indexing device. This has the advantage that the measuring elements do no work and therefore maintain their accuracy.

By means of this device, jigs may be laid out, or production work may be bored accurately without a jig. The head is adjusted vertically and the table crosswise to the hole lowest and furthest to the rear of the jig or other job. Standard $\frac{5}{8}$-in. round end measures are then used with a 1-in. inside micrometer adjusted to the desired fractional inch reading. These are inserted in the troughs provided for this purpose on the column face and the side of the table, sufficiently to correspond with the exact distance to the center of the hole highest and furthest forward in the work.

The measures are held in firm contact with each other and with the hardened abutments on the top of the spindle head and side of the saddle respectively. The dial indicators are then brought into contact

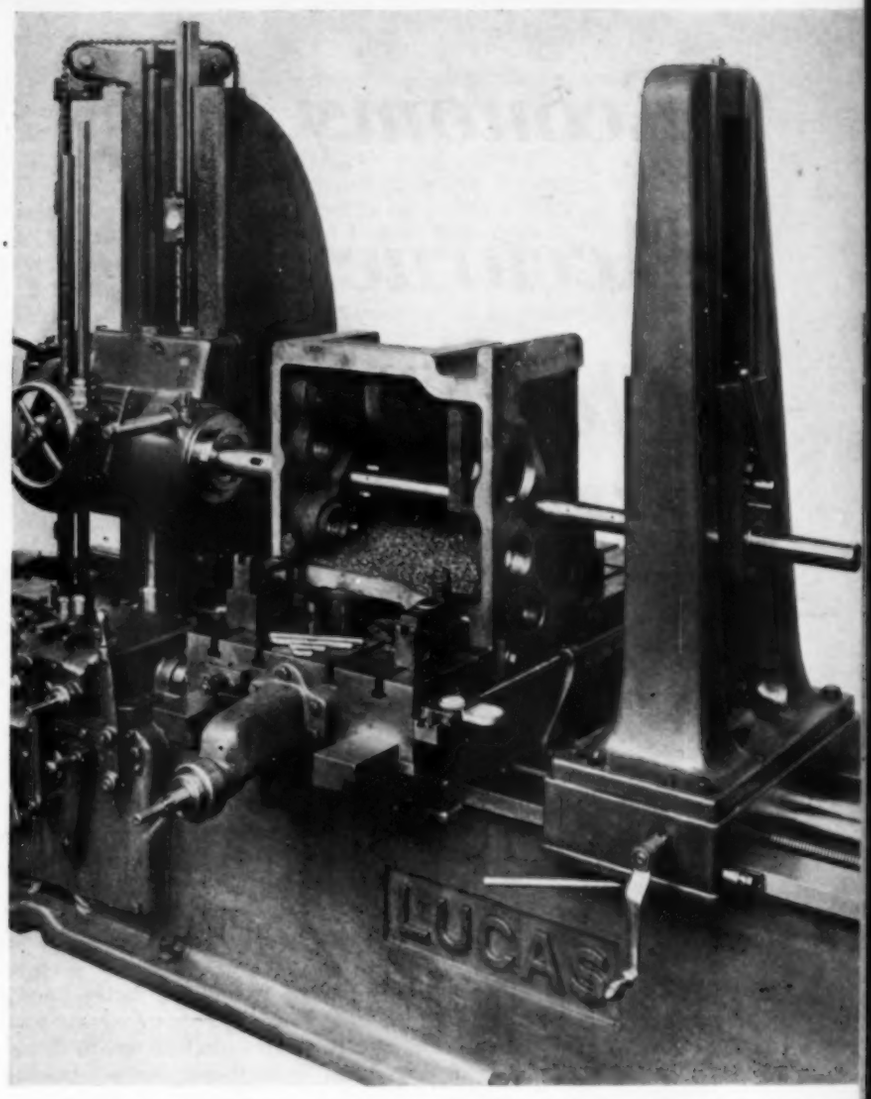
Jig Boring

with the opposite end of the string of end measures, their holders clamped to T-slots in the trough strips and the dials rotated to read zero on the indicator pointer.

After the first hole is bored, inside micrometer settings are changed and sufficient end measures are removed to correspond to the exact center distance, vertically and horizontally, to the next hole. The head is raised, and the table is adjusted upward until the remaining strings of end measures again contact the dial indicators, and their pointers are brought to the same zero reading. This procedure is continued until all the end measures are removed, and the inside micrometer is adjusted to read zero (but is not removed).

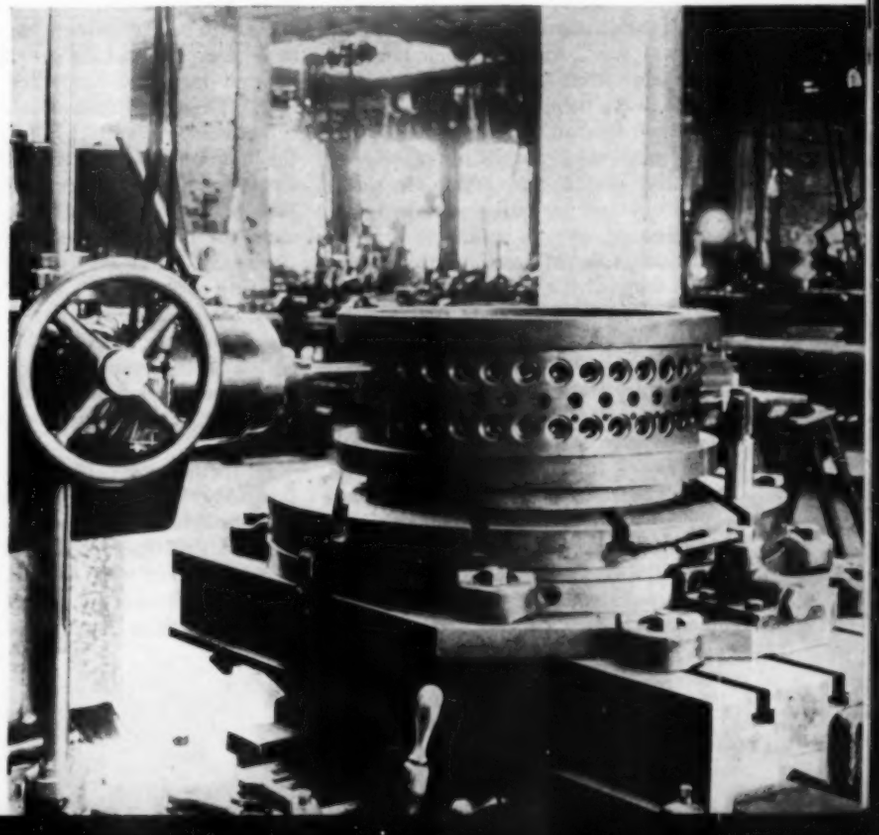
In the accompanying view, showing the machining of a lathe apron, a variation of this method is employed. The dial indicator indexing device is used as before, but in this case, instead of first positioning the spindle with the hole lowest and furthest to the rear, a plug in the spindle taper is brought into contact with locating surfaces in vertical and horizontal planes on the work-holding fixture. To permit the use of stub tools, which are more easily changed than longer through bars, piloted at the rear end, the fixture is reversed 180 deg., by squaring it up with an accurately planed cross slot in the table. Holes in line bored from opposite ends are tested by passing a close-fitting arbor through both simultaneously. This method of inspection guards against possible offset and constitutes a severe test, because any misalignment would be doubled by reversing the job.

The method of indexing described has been found superior to the inclusion of vernier scales in the machine slides because of the difficulty in reading them at a considerable distance from the operating shafts of the machine, at which point the comparatively heavy slides have to be adjusted to a predetermined vernier reading. This is an entirely different and much more difficult matter than adjusting the vernier head of a caliper to measure a distance already fixed, as for instance, across plugs in bored holes to check their center distance.



This job shows the application of the dial indicating indexing device employed with special end measures corresponding to the center distances

In this example of a cylindrical jig several rows of radial holes are accurately bored by means of a swiveling table for angular indexing



Economy
Accuracy
Flexibility

In the JOBBING TOOL SHOP

F. JOS. LAMB
President, F. Jos. Lamb Company

WORKING against predetermined estimate costs and close delivery times in a shop where business fluctuates so rapidly that the force frequently must be expanded from 50 to 250 operatives within a 30-day period requires flexibility in equipment, operatives and supervision. Broadly speaking, two major types of problems are encountered: First, equipment must be capable of great accuracy and yet must be flexible enough to cover a wide range of work; and second, the toolmakers and machine operatives must be versatile and capable of performing a variety of work without much detailed supervision from management, which requires in its turn, as an example, that the superintendent be capable of estimating new work, adjusting trouble in customers' plants, and selling, in addition to duties naturally pertaining to his position.

A wide range of work must be covered—design of the die to meet the customer's print of the part, making the foundry pattern and the casting, using Keller machines for forming the dies. The dies are tested before release to the customer. Considerable time may be saved where these diverse operations are included in one plant. The F. Jos. Lamb Company secures these advantages by having a company making its patterns located next door, and a foundry company located across the street. Floor tracks running to all heavy machines with cars to the height of the machine bed plates conserve crane service and eliminates heavy lifting of dies, tables and rotating devices.

In addition to the usual run of shapers, lathes, grinders, radial drills and thread millers usually found in tool and die shops, the outstanding equipment are Keller machines, jig boring machines, and horizontal boring machines.

Jig Boring Equipment

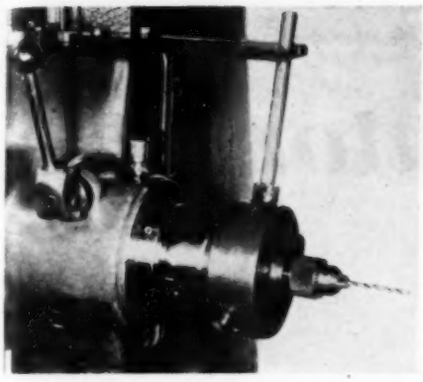
The jig boring machines used in this plant are furnished with slots at right angles to each other, conforming to table travel, in which are placed circular end measures, including a micrometer. These end measures in each case act against a graduated dial, which with the micrometers in the train of end measures permits measurements to a "tenth." While this is standard equipment for up-to-date tool shops, adaptations and additions in the form of a rotating bed plate to handle holes drilled in a circle, and an extension table to handle large work, both of which are bolted to the standard slide of the machine, make it adaptable to a wide range of work where extreme accuracy is required.

A further case of adaptability and flexibility in jobbing equipment is exemplified in the use of a recently developed drill speeder of our own design in conjunction with a horizontal boring machine. The machine itself has a range of speeds from 20 to 600 r.p.m. In drilling small holes and in working with white metals such as aluminum, higher speeds are necessary. By placing this small compact drill speeder in the machine spindle each speed of the machine is multiplied by four so that the range of speeds now runs from 20 to 2400 r.p.m. thereby greatly increasing the range of use for drilling and light milling.

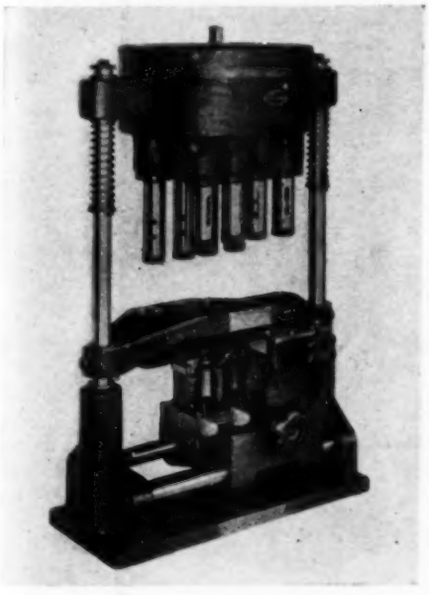
Use of this drill speeder on a two-spindle drill for drilling holes in a connecting rod for domestic refrigerators further illustrates the flexibility and economy secured in machine equipment by its use. Two holes were to be drilled in the forging, 1½ in. in one end and ⅞ in. in the other. One motor drives both drill spindles. While 250 r.p.m. was satisfactory for the larger hole, it was not fast enough to secure maximum economy for the smaller hole. By using the drill speeder on one spindle for the smaller hole the rod could be drilled complete in one set-up end at the proper speed conforming to the size of the drill. Thus the range secured covers not only proper speeds for different drill sizes when drill spindles are in multiple but enables material ranging from steel to aluminum to be handled in the same machine.

Accurate Depth Facing

An adjustable sleeve for depth facing developed in our shop permits adjustment to 0.0015 in. for this class of work and eliminates measurements for depth except for cutter wear. This device, adjusted easily and quickly to the machine spindle, secures economies in reducing operator time. Adjustment, by turning the ratchet may be made with-



Drill speeder, designed and built by F. Jos. Lamb Co., in place in horizontal boring machine the range of which is considerably increased thereby



Fixture and 8-spindle head for drilling and reaming simultaneously two holes in two Chrysler starter pedals. A typical contract tool shop job

out removing the sleeve from the spindle. The splines in the sleeve are cut in an automatic spline miller.

It has been the practice for some time for jobbing tool and die shops to job out in turn the die design work. The print of the part from the customer is turned over to the design jobber who makes the die design, which in turn is approved by the customer after which the casting is made. The die blanks are then placed on a Keller machine to be formed from the wooden models. Presses for the tryout are provided in the jobbing shop, or if the range of work is too large for these tryout presses, the tryout is done in the customer's plant. Receiving a die O.K. on the second piece run off is no infrequent performance, so accurately has automotive die work in the die shops become. This is no small task when it is considered that a set of dies for a radiator and grille may run as high as $35,000.

Tool and die inspection in addition to accuracy in machine equipment and flexibility in operatives and supervision, is an essential. Sets of gage blocks are in use in all the better shops. While expensive, these and similar devices insure that tools and dies are accurate before delivered to the customers, a requirement in the independent shop.

While overhead in the form of systems is something to be avoided as far as possible, yet some devices prove their worth. In our shop a progress report is maintained on all jobs in conjunction with the job cost system. The estimator estimates the hours of work required which becomes an important cost criterion. Three or four times weekly—in many cases daily—the foreman estimates the percentage completion of the order. This is entered in its appropriate space on the progress report and permits a comparison with cost figures. If the job is 50 per cent completed and 75 per cent of the estimated cost has been expended, an opportunity is given to check into the remaining work for purposes of reducing the cost.

Purchasing agents of prospective customers are interested in knowing the range of equipment afforded by the independent tool and die shop. In this shop we have used a printed circular as an aid in getting business. All of our equipment is listed both in the shop and in the drafting room.

Incidentally, it is a continuing policy with us to buy new machine tools only. Requirements of accuracy on the kind of work we do are so strict that used machines would have to be entirely rebuilt, and that work would distract the attention of our executives from the work for our customers on which we make our living.

One of the great advantages of the jobbing tool shop is that it is sought by skilled all-round toolmakers. This means that the operating force, both executives and operators, are versatile, and that operations can be handled with the maximum of flexibility. On the other hand, the fluctuations in business are so considerable that it is difficult to take on apprentices. By the time a boy taken on in good times had received his training the business cycle might have swung from peak to trough, and there would thus be no work for him when he was ready for it. A further handicap on training in such shops is that low overhead provides little for supervision. The men in the shop must therefore be of the type capable of carrying on their work with a minimum of attention from the executives.

Precise, accurate work on modern equipment, coupled with flexibility of force and versatility of the individual are the stock in trade of the contract die and tool shop. They are the factors that have made the good shops in this field indispensable to the production industries.

Equipment of a Contract Tool Shop

(Condensed from the complete list of machines and equipment supplied by the F. Jos. Lamb Co. to its customers)

2 Keller-type engraving machines
3 Horizontal boring machines
2 Jig borers
1 Vertical surface grinder
4 Internal grinders
1 Tool and cutter grinder
1 Plain cylindrical grinder
3 Universal cylindrical grinders
6 Surface grinders
1 Disk grinder
12 Toolroom lathes with attachments
3 Turret lathes
6 Radial drills
3 Vertical milling machines
4 Knee-type milling machines
1 Hand milling machine
16 Shapers
2 Slotters
10 Upright drills
4 Sensitive drills
Miscellaneous presses, flexible shaft tools, portable tools, thread and spline millers, keyseaters and gear shapers
Hardening and inspection equipment
Drafting boards, with parallels—50-man capacity

Templets for Isometric Projection of Circles

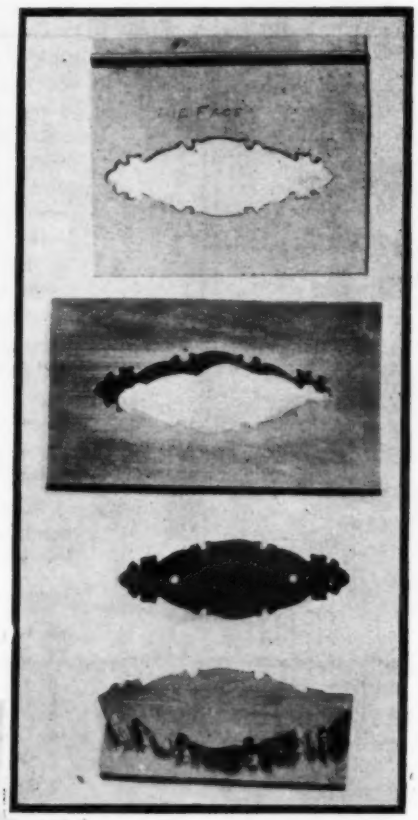
J. E. MOORE

In making illustrated instruction sheets for isometric drawing, the straight lines and the angles were easy to draw, but the isometric projections of circles took time and care. Since the scale was the same in many of the drawings, I copied the projection of each new circle on heavy paper, marked its diameter and its scale and cut it out for a pattern. These patterns were hung on brads near my drawing table, and the collection gradually grew.

Now, when I have to draw the isometric projection of a circle, after the major and minor axes have been established, I take the proper pattern from its brad and use it as a templet, scribing a line about it on the drawing with a pencil.

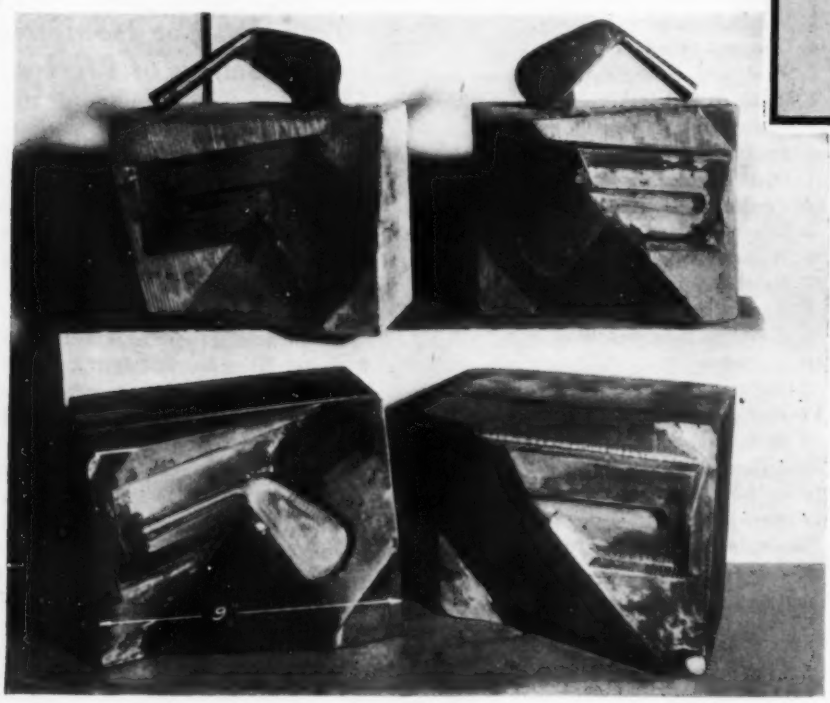
Automatic

A multiple spoon die is made with the aid of an indexing fixture from a single master; the tracer of the Keller machining follows the model above and guides the cutter in the work mounted below



Above—Typical blanking dies and templets demonstrate the intricacy of the work that can be performed automatically

Left — The plaster models above were used to form the pair of forging dies for golf club heads below

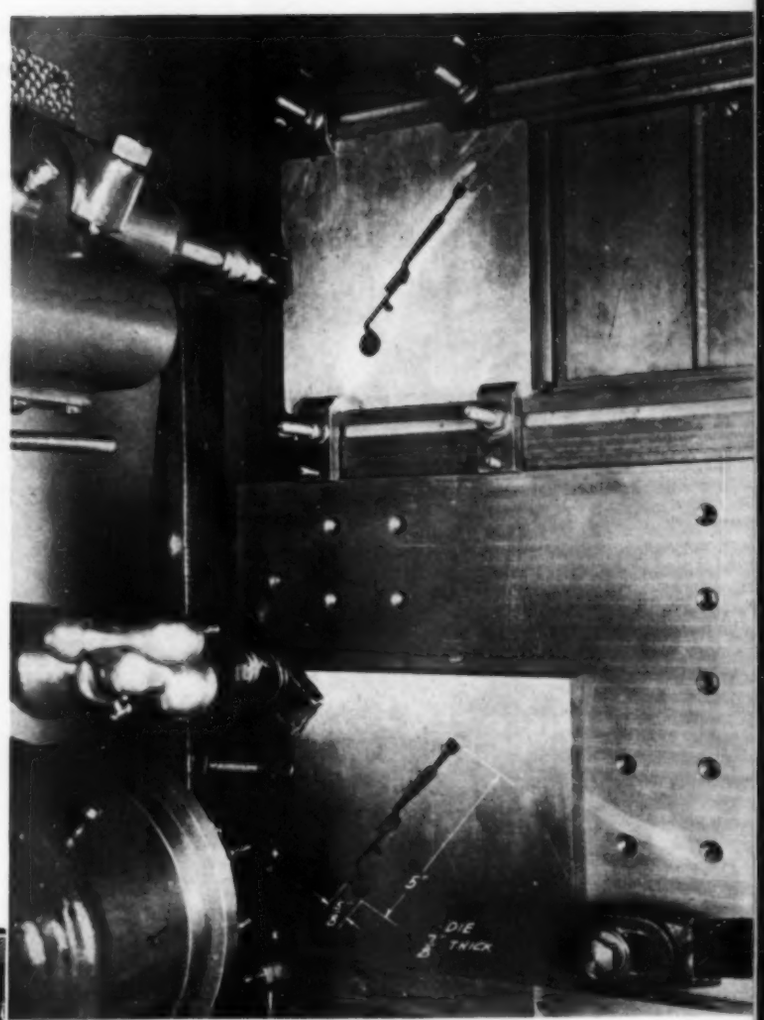


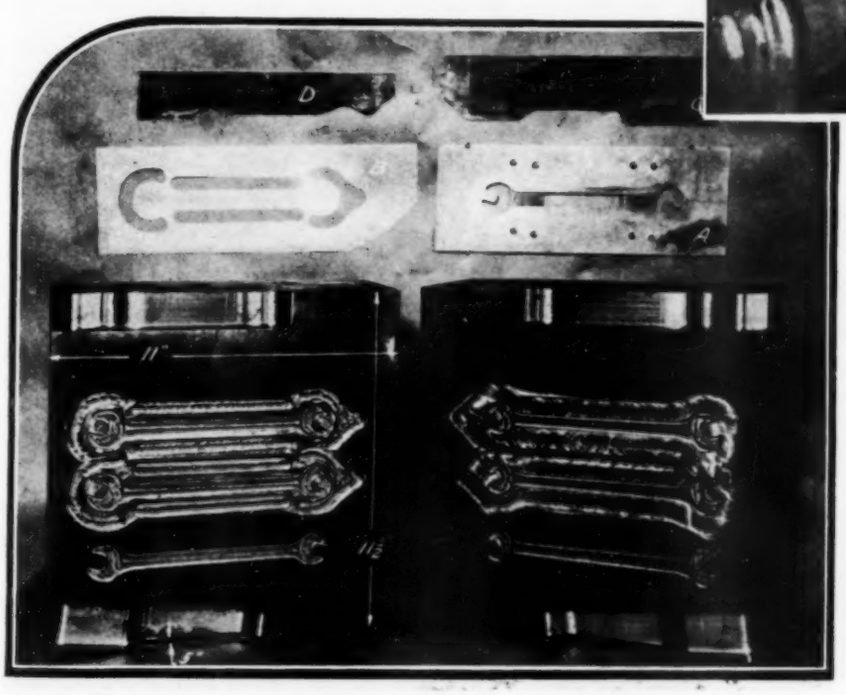
Die-Sinking

• In former years intricate dies were made only by hours of painstaking effort on the part of highly skilled men. It was necessary for them to lay out the irregular contour, rough out the work, which often required the removal of large quantities of metal, and then to finish carefully the two die halves so they would fit precisely.

Skilled men are still needed for die making, but the work is greatly aided by the use of the automatic methods embodied in the Keller tool-room machine. Forging, blanking, and forming dies and plastic molds are among its many applications.

The die contour is formed by an end mill which successively passes over the work taking parallel horizontal cuts. The cutter is automatically guided by a pointer which follows a master form, mounted directly above the work and which may be made from wood plaster, metal or from a sample of the part to be formed in the die. As many cuts as necessary may be taken. Then the diemaker puts on the finishing touches to prepare the dies for production.



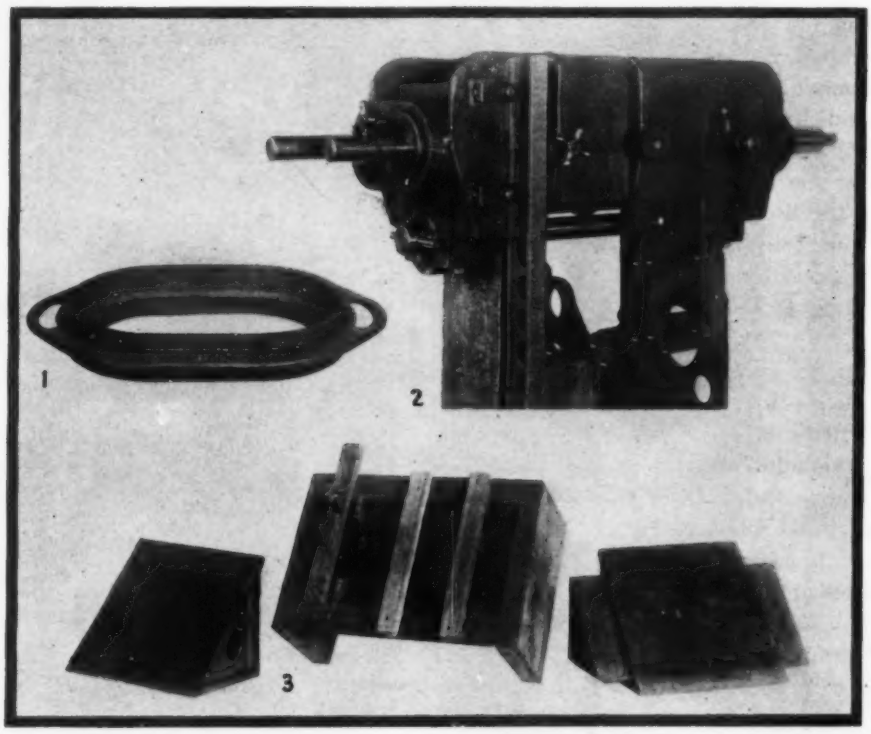


Above — For this die, the punch was made from a master templet filed out of thin metal. The female templet for cutting the die illustrated was produced by casting type metal around the original master; this casting then became the master for cutting the female half of the die

Left—These forging dies for a machine wrench were produced automatically from the templets shown above them

Welded vs. Cast Jigs

Cast design is logical for some jigs, but for many others, welding results in a saving

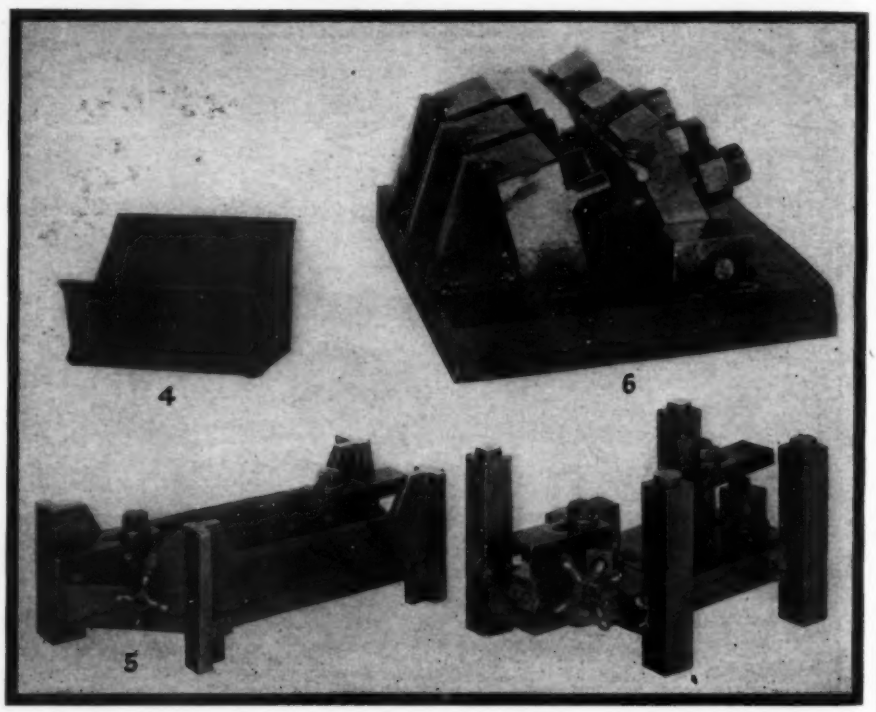


Cast iron is the proper material for many tools and jigs, as exemplified by the following: Fig. 1—Special surface plate pattern. Fig. 2—Cast-iron finish boring fixture. Fig. 3—Cast-iron angle block, core box and pattern

L. E. FULLER
Tool Engineer,
Brown & Sharpe Manufacturing Co.

THE PROBLEMS of the tool room are greater to-day than heretofore because of the changes that are taking place in machine design. Since designs do not run for years but are constantly changing as mechanical, hydraulic and electric controls are improved, the application of machine tools is almost limitless. Tools used in making them, such as jigs, fixtures, and gages, must therefore pay for themselves in a short time.

To meet this condition, welded tools are unquestionably the answer, and they have come to the fore at the right time, because they can be made at less cost and in a shorter time than has been possible heretofore. The interchangeability of clamps, brackets, and small parts is much more easily accomplished with the gas torch and arc welder. Clamps that



In laying out welded jigs the designer should forget the practice followed for cast iron. Fig. 4—Arc-welded angle block. Fig. 5—Cast-iron and arc-welded jigs for similar parts. Fig. 6—Milling fixture arc-welded from rough sketch

were formerly forged are now built up by arc-welding blocks, thus eliminating nearly all machining in the tool-room.

Cast-Iron Tools

There are some cases where a pattern Fig. 1 and a casting would be the choice for a tool. These are chosen for the special surface plate shown, because the design of this tool does not lend itself to arc-welding, and also because use of a cast-iron surface is better practice for scraping.

Fig. 2 shows a finish boring fixture. This fixture is made of cast iron because of the extreme accuracy required to be maintained over a long period of time. The center distance of the tool holes remains more stable than with boiler arc-welded together for the type of tool.

Where standard stock cast-iron jigs made from the same pattern can be used to advantage, this method of construction should be the choice instead of gas or arc welding.

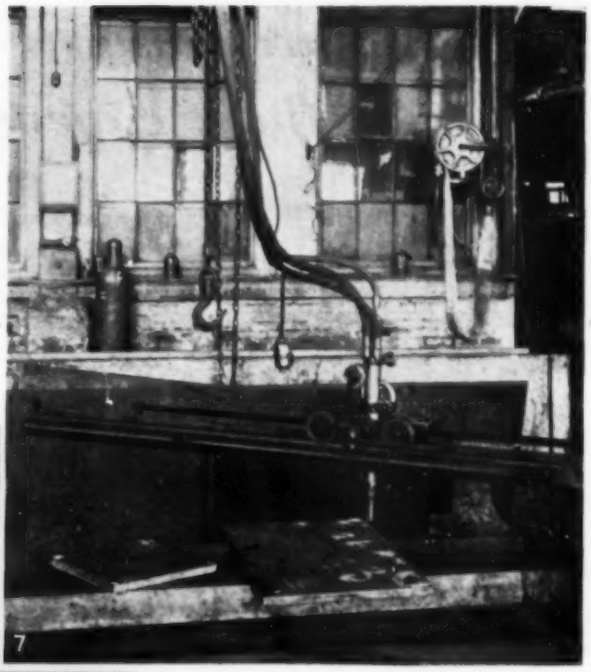
Welded Tools

The economies to be made with arc-welded special tools are many. In studying the thousands of both types which we have made, we find a substantial saving in favor of the arc-welded tools. These savings can be readily understood by a comparison of similar tools. Fig. 3 is a simple cast-iron angle block for which a core box and pattern are required. Fig. 4 is an arc-welded angle block of similar size and design, which was made of plates welded together without any pattern or core box. The welded block is lighter and has sufficient strength to compare with cast iron.

Greater savings can be made (up to 30 per cent in some cases) in the manufacturing cost of jigs and fixtures, compared with similar cast-iron tools, if one designing tools will forget about the conventional type of cast-iron jigs, and produce a tool from stock steel shapes, (as shown in Fig. 5) which are satisfactory for many parts.

The extent of surface areas, which are to be machined in the tool room should be considered, as it takes about 5 per cent longer to machine the same area of steel over cast iron. This may be offset, however, by reducing these areas to a minimum.

The following simple equipment is sufficient to fabricate a wide range of welded jigs: Fig. 7—Gas torch for cutting plates. Fig. 8—Arc-welder, table and jig shown on table being tack-welded



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The equipment required for economical production of welded tools up to the point of machining, is as follows: First, a gas torch suspended on an arm, Fig. 7. This torch is used for cutting long, straight and angular plates. In addition, a suitable arc-welder, Fig. 8, is required. This is used in conjunction with a metal grounded table. The jig on this table is first tack welded, and later completed with a bead weld of proper strength for the tool. This equipment, you can readily see, is small in comparison with the machinery required for making patterns, core boxes and molds.

Good, accurate tools can be made by welding, and if normalized will keep their shape and last as long as required. Surfaces subject to excessive wear should be hard-surfaced with hardened blocks, or by welding on stellite rod. The feet of jigs so treated can be surface ground for finish.

All of the tools which have been described were made from drawings. However, the tool shown in Fig. 6 took just a few hours to make. This fixture for milling a special part was put on the machine ready for work the same day that it was called for. It was made from a rough sketch with a few figures. This would have been impossible if a pattern, mold and casting had been necessary.

There does not seem to be any limitation to the type of tools that can be welded, except a very few cases, some of which have been mentioned. If one will take advantage of the opportunities offered by the arc-welded tools, he has gone a long way toward solving his present and future tooling problems.

Die Standardization Without Expensive Design

JOHN C. DENSE

MOST tool engineers are in favor of standardization of die design. It can be controlled with certainty when the necessary time and sufficient funds are allowed to design each die completely, after having set up sufficient standards to insure getting all of the things that have been found by experience to be desirable in the type of tool in question.

Standardization of die parts has probably been carried out to a greater extent than the standardization of most any other single type of tool; this is no doubt due to the basic similarity of design of all dies and die parts. This article discusses the standardization of dies without the expense of designing each die individually.

This may be accomplished in two ways. One is by the writing of a specification sheet and the other way by having a standard design for each type of die, such as plain blanking dies, compound blanking and perforating dies, compound blanking and drawing dies, compound blanking, drawing and perforating dies, follow dies of different types.

The making up of the specification sheet for each of these types of dies should be done with care. The part to be made in the die must be studied to determine the most economical way to produce it in the light of both production cost and tool cost. The important thing is to incorporate all of the things that have been found to be good, and still more important, to leave out the features that have been found to be objectionable from past experience.

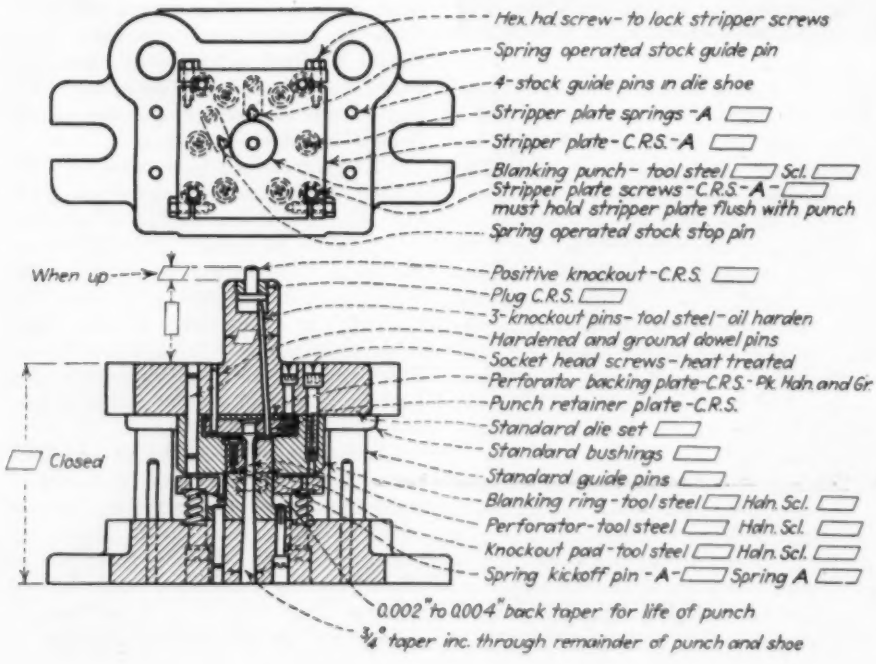
Before attacking this problem it is assumed that some standards have already been set up, as they have in almost any plant that has been building dies or having them built for any great length of time. Reference is made to such parts as die sets, die pads, springs, spring pads and knockout mechanisms.

The most economical method is to have copies of these specification sheets run on a mimeograph or some such copying machine leaving the necessary blank spaces where the important dimensions and standard part numbers may be filled in.

A sample specification sheet for a compound blanking and perforating die is shown and may be used for this type regardless of the size of the part to be made in the die.

A specification sheet such as this will guarantee always getting the same type of die with the added assurance that the punch press foreman will not find it necessary to call for any additional gadgets to be put on the die or to take any off and throw them away.

With a small amount of extra work, a standard drawing may be made which will control the design still more effectively than does the specification sheet. Such a design is shown below. In both the specification sheet and the standard die design it will be noted that a spring pin stock stop is called for in the spring stripper plate. This pin is removed when using a roll feed.


Hex. hd. screw - to lock stripper screws
Spring operated stock guide pin
4 - stock guide pins in die shoe
Stripper plate springs - A
Stripper plate - C.R.S. - A
Blanking punch - tool steel Scl.
Stripper plate screws - C.R.S. - A - must hold stripper plate flush with punch
Spring operated stock stop pin
When up
Positive knockout - C.R.S.
Plug C.R.S.
3 - knockout pins - tool steel - oil harden
Hardened and ground dowel pins
Socket head screws - heat treated
Perforator backing plate - C.R.S. - Pk. Hdn. and Gr.
Punch retainer plate - C.R.S.
Standard die set
Standard bushings
Standard guide pins
Blanking ring - tool steel Hdn. Scl.
Perforator - tool steel Hdn. Scl.
Knockout pad - tool steel Hdn. Scl.
Spring kickoff pin - A Spring A
Closed
0.002" to 0.004" back taper for life of punch
¾° taper inc. through remainder of punch and shoe

SPECIFICATION SHEET for COMPOUND BLANKING and PERFORATING DIE

A compound die, tool number..... to blank and perforate part.....on a .....punch press. Danly die set.....; guide pins.....; bushings.....Closed die height ..... Punch stem.....diam. .....long. The punch holder to carry the blanking die block to be made from.....steel.....thick; a knockout pad made from.....steel, in which will be a spring kickoff pin, this pad to be operated by a positive knockout pin projecting.....above top of punch stem. The perforator to be mounted in a punch plate screwed and doweled to punch holder, and perforator to be backed up by a pack hardened plate ¼-in. thick.

The die shoe to carry the blanking punch, to be made from.....steel .....thick, this punch is also the perforating die block carrying the hole or holes for perforations. These holes will be perfectly straight for a distance of.....Below this the back taper will be ¾ deg. inclusive angle, this taper to extend clear through the die shoe. The punch to be surrounded by a spring stripper plate made from..... steel.....thick, this plate to be operated by .....springs of.....lb. capacity and retained level with top of punch by.....shouldered pad screws. This plate will also contain two spring operated pins, one for a stock stop and located approximately the thickness of stock to be punched away from the edge of the blanking punch and the other pin to be directly behind the blanking punch to act as a stock gage. The die shoe will have four stock guide pins..... diam. pressed into the die shoe and projecting ½ in. above the stripper plate.

Die block, blanking punch, and punch plate will be held down with heat-treated socket head screws and located by hardened and ground dowel pins. Die block, blanking punch and perforator to be hardened to.....scleroscope. Twenty-five blanks to be made in this die and delivered attached to die, blanks must be free from burrs and within limits specified on engineering print.

EDITORIALS

VOLUME 78 AMERICAN MACHINIST NUMBER 18

ESTABLISHED 1877

McGRAW-HILL PUBLISHING COMPANY, INC.

K. H. CONDIT F. H. COLVIN

EDITORS

NRA Overhaul

PRESIDENT ROOSEVELT'S decision to keep General Johnson on the job and overhaul NRA may not come too late to save the rapidly sinking ship, but it has been so long delayed that the chances are not as good as they should be. When all three parties interested in such a bold experiment as NRA are disappointed to the point of open rebellion it is high time to do something about it.

Consumer dissatisfaction was probably inevitable from the first. The consumer was expected to foot the bills arising from the Administration effort to raise wages and restore profits. In view of the manner in which he had profited during the previous two years from the panic prices of cut-throat competition it was only fair to expect him to take his turn at paying up, but human nature is not naturally sportsmanlike. Once having become accustomed to low prices for everything, we expand our scale of living to correspond, and any retreat from that scale is a rearguard action of bitter resistance.

Organized labor misread the intention of Section 7a and misled the rank and file correspondingly. After the months of starvation wages that had been the lot of the great mass of working people it is not to be wondered at that they are disappointed at the results of the law which, they were led to believe, would make everything right.

By and large, business men played the game with Johnson and the President and tried hard to make NRA work. They have already paid a tremendous bill in time and services of various industrial leaders, not to mention the traveling expenses and hotel bills incidental to many futile trips to Washington. Many groups have tried to grasp too much advantage for themselves. Others have attempted codification of practices that are totally unenforceable. A few have done only those things that good common sense indicated. But unless the whole structure is to collapse and the dirty game of chiseling competition is to be resumed, drastic steps must be taken, and at once.

It would be a great pity to see all of the work that has been expended on NRA go to waste, because there are good things about it. Business must be consulted if the coming overhaul is to succeed, and it must give its best thought to save the parts of NRA worth saving.

Adequate Light

INCREASES in orders and improvements in profits have brought many companies to the point where consideration of obsolete equipment is more than an academic question. First attention has, of necessity, been given to machine tools and other production equipment, much of which has been hopelessly inadequate for years to meet the demands made of it. The upward shift of the curve of machine tool orders has given clear evidence of this trend.

More recently the inability of machines a few years old to meet the current exacting requirements as to accuracy has added to the worries of superintendents and other plant executives. Adequate lighting is an important factor in obtaining accuracy as any toolmaker will testify. Even the operator of the most modern machinery will have trouble meeting the limits specified by the engineering department if he can't see clearly what he is doing.

In the first statements released by one of the large electrical manufacturing companies in the campaign for better industrial lighting, case after case is cited to prove the part played by adequate lighting in increasing production. No one questions the desirability of increased production except those who hold that we have reached the end of our technical and economic development and must fall back on a policy of spreading a strictly limited amount of work as far as possible. But in laying the emphasis on output it will be well to remember that the factor of accuracy is to be reckoned with in almost every shop today, and that in many shops it is of paramount importance.

"Buy Efficiently"

SENSE and sentiment are in constant conflict when it comes to buying. Except in extreme instances, no one hesitates to sell in any market. But when it comes to purchasing, propaganda and appeals to patriotism or prejudice run riot in every country. Sydney, Australia, presents an interesting study in this connection.

In order to provide employment, the government appropriated three million dollars for two hundred new tram cars. Of this amount over seventy thousand dollars was for gears and pinions. On account of previous experience the Transport Commissioner placed the order with an American firm. This quite naturally raised a howl from local gear makers and re-

sulted in a compromise which gave local makers about fifteen per cent of the order, in spite of the fact that no other gears had ever given the service of the American product.

The Commissioner was faced with a real dilemma. Experience had proved the economy of the foreign gears in service, and that maintenance on the new cars would be less with these gears. Local pressure, political and otherwise, and doubtless his personal preference, demanded that money be kept in Australia. It took real courage even to split the order as he did.

Every buyer is, to some degree, faced with the same dilemma. Shall he buy on sentiment or prejudice, or shall he buy the best obtainable, considered from all angles?

It may help decide if we remember that all trade is, in the long run, a form of barter. When Australia spends seventy thousand dollars in this country an equivalent amount, in some form, leaves here and eventually gets back to Australia. In spite of those who are strenuously advocating self-sufficiency or strict nationalism in trade, most careful thinkers feel that interchange of products is not only highly desirable, but inevitable. Improvements in transportation of all kinds, and in communication facilities, make isolation a practical impossibility. So instead of "Buy American" or "Buy British" we might all adopt the slogan "Buy Efficiently."

.CHIPS.

Washington—Integration of its far flung activities heads the Administration's current program . . . Based on Donald Richberg's report, recommending coordination of the many facets of the New Deal, the President called together General Johnson, Secretaries Wallace and Perkins to reshape NRA and other Federal bureaus . . . Rumors of internal dissent, of resignations are warmly denied . . . Meanwhile Commerce Secretary Roper radio broadcasts that the Administration is squarely behind the profit motive . . . Section 7a bit the hand that fed it when General Johnson, rebuked by the Labor Board, reinstated John L. Donovan, discharged NRA employee and president of the NRA union affiliated with the A. F. of L. . . . In the first change of a major code by executive mandate, President Roosevelt cut the hours of cotton garment workers 10 per cent, raised their wages 10 per cent . . . He also increased the loan allowance to cotton producers from 10 to 12 cents a pound, while the RFC set aside $250,000,000 to cover such loans . . . Drought losses force AAA to revise crop curbs, adding 5 per cent to 1935 wheat quotas . . . Duties on livestock feed were cancelled by the President in another drought relief move . . Al Smith, John W. Davis, Nathan Miller and Representative Wadsworth head nonpartisan American Liberty League formed to "defend constitution" . . . Navy awards contracts for 24 warships . . . Speaker Rainey died suddenly at 74.

Foreign—Germany endorses Hitler 10 to 1 in combining duties of President and Chancellor, but Nazis seek to convert four million who voted "no" . . . Reich starts 100-day campaign to reduce imports and eliminate industrial waste . . . Use of copper and nickel banned for domestic products . . . Mussolini withdraws troops from Austrian front and renews Italy's pledge to maintain Austrian independence . . . Soviet sends strong protest against Jap aggression, particularly towards Chinese railroads . . . Russia gained 29.3 per cent in heavy industries during the first half of 1934 . . . President Roosevelt accepts U.S. membership in the International Labor Organization, at Geneva . . . withdraws marines from Haiti.

Finance—Drop in dollar brings first U.S. gold export in a year . . . French fear monetary turbulence as pound falls below 76 francs . . . Government bonds dip as inflation rumors are reviewed . . . RFC Chairman Jesse Jones announces 100 per cent guarantee to banks in order to speed industry loans . . . Banks advertise readiness to extend home repair loans . . . "Keeping up with the Jones" psychology to be used to promote home renovation program . . . Eugene R. Black resigns as governor of the Federal reserve . . . Harvey C. Couch leaves RFC . . . Treasury makes plans to meet September and October maturities.

Industry—Merger rumors abound with Auburn, Hudson, Reo and Pierce-Arrow mentioned in auto deal . . . Another talked-of combine is Republic Steel, Truscon and Corrigan-McKinney . . . Royce G. Martin, president of Moto Meter, elected head of Electric Auto-Lite in consolidation move . . . Alvin McCauley, Packard head, elected president of the Automobile Manufacturers Association, the rechristened National Automobile Chamber of Commerce . . . Auto code which expires September 4 is under labor fire . . . R. A. Hunt, Aluminum Company president, states that closed shop, check-off and universal wage are not matters for arbitration . . . Class I railroads unite to test legality of pension law . . . Locomotive orders are at highest point since 1931.

Trade—Wholesale commodity prices are lifted to highest level since March 1931 by sharp rise in farm products . . . Auto exports for first half were 155 per cent better than 1933.

Indicators—*Business Week* index drops one point to 58.1 . . . Power consumption continues upward, but carloadings drop . . . Iron and Steel Institute index of steel production dropped to 19.1.

Machinery Trade Balance Favors U. S.

R. E. W. HARRISON
Chief, Machinery and Agricultural Implements Division
Department of Commerce

In view of pending negotiations in respect to tariffs brought about by the passing of the reciprocal tariff bargaining act, a study of the overall trading situation provides some interesting commentaries. Briefly, the situation condenses down to the following:

During the month of June, 1934, we exported industrial machinery to the value of $8,103,967 and imported machinery within the same classifications to the value of $599,021. In round figures $8,000,000 against $600,000, the figures for the first six months of this year being $44,812,801 exported as against $4,043,058 imported. Reduced to a percentage our imports amounted to 9.2 per cent of our exports, and the figures quoted above are correct to within a probable 2 per cent of error.

When it comes to domestic production, we are confronted with the difficulty of making an estimate, as no accurate statistical data are available. However, the analyses are based on the following main classifications:

1. Power-generating machinery except electric and automotive.
2. Construction and conveying machinery.
3. Mining, well and pumping machinery.
4. Power-driven metal-working ma-
5. Other metal-working machinery.
6. Textile, sewing and shoe machinery.
7. Other industrial machinery.

A study of indices, census reports, etc., indicates that our total domestic production of machinery in the classifications referred to above, which it will be noted exclude all transportation equipment, including automobiles and all electrical equipment for the first six months of this year, will amount to approximately $600,000,000.

Carrying the analysis still further, it will be seen that our imports in round figures amount to less than one per cent of our total production, and our exports are approximately 7.5 per cent. This latter figure applies also solely to industrial machinery production recorded under the above-mentioned classifications.

The undoubted importance of our vast domestic market cannot be overemphasized; however an inference should not be drawn from this that our export business is not also of major importance. Furthermore, having regard to the high quality and profit earning capacity of American machinery, the figure 7.5 per cent is low and indicates that an expansion of sales effort in foreign markets is desirable and necessary.

Exports and imports of industrial machinery from and into the United States during June, 1934, classified by countries, are as follows:

Country	Imports	Exports
Austria	$254	$3,601
Belgium	779	53,687
Czechoslovakia	5,472	9,878
Denmark	7,684	19,100
Finland	115	12,818
France	8,543	267,873
Germany	326,106	164,143
Italy	454	97,854
Netherlands	314	97,709
Rumania	19	108,912
Soviet Russia in Europe	.....	589,070
Spain	217	70,387
Sweden	80,510	56,983
Switzerland	19,978	40,350
United Kingdom	141,268	978,596
Canada	4,523	1,879,039
Mexico	39	576,450
Cuba	171	59,259
Dominican Republic	425	9,595
Japan	1,923	506,769
South Africa	227	226,575
Panama	.....	66,481
Trinidad and Tobago	.....	54,300
Argentina	.....	206,589
Brazil	.....	161,752
Chile	.....	71,021
Colombia	.....	163,458
Peru	.....	51,924
Venezuela	.....	369,547
British India	.....	166,029
China	.....	112,416
Netherlands East Indies	.....	52,624
Philippines	.....	98,346
Australia	.....	137,145
Other French Africa	.....	53,002
All Other	.....	510,685
Total	$599,021	$8,103,967

From this table, it will be noted that our two chief sources of supply are Germany and the United Kingdom. These two sources alone account for 78 per cent of the total imports. These imports, in the case of Germany, are mainly made up of ball bearings and parts, printing presses and parts thereof, chocolate and confectionery machinery, and various unclassified items; and in the case of the United Kingdom, cotton and other textile machinery and parts and tobacco machinery and parts. Another item of much interest to domestic producers is represented by the importation of nearly $46,000 worth of ball bearings and parts from Sweden.

Courtesy Haynes Stellite Co.

***Hard Facing with a Torch*—For service with high pressure superheated steam this 9-in. valve disk is surfaced with a non-galling alloy of cobalt, chromium and tungsten especially resistant to abrasion. The disk is preheated to 1100 F., hard faced by welding on ⅛ in. of alloy, reheated of 1250 F. and cooled in the furnace**

German Machinery Industry Shows Improvement

Increased local activity and a decrease in import have resulted in considerable improvement in the German machinery industry for the first half of 1934, according to the Verein Deutscher Maschinenbau-Anstalten. This association reports that orders to German machine producers amounted to 70 per cent more during six months of 1934 than for 1933.

Motor Manufacture Continues To Slacken

DETROIT—Moderate declines in both sales and production of automobiles ruled for the last half of August. July passenger car sales to customers are estimated at 230,000, reaching a peak for 1934. This compares with 223,642 in June and 185,700 registered in July, 1933.

Typical of the August trend was Buick's drop of 320 in sales the first ten days of August as compared with the last ten days of July, and a reduction of 150 in Dodge passenger car sales the week ending August 11. Production for August is, however, estimated at only moderately below the 238,934 units produced in the same month last year. Some acceleration of the downward rate of sales in late August was not unexpected, because of the cumulative effect of the drought, but to date losses in the areas worst affected have been counterbalanced by improvements in other sections and by government subsidies to farmers.

The three leading low priced manufacturers reduced production schedules the week ending August 18, cuts running from 600 to 2,000 units. Slight gains were recorded by Graham, Hudson, Packard and Auburn. Studebaker and Cadillac resumed operations during the week. The reduction in total schedules August 18 over August 11 is not expected to exceed 4,000 units.

Including estimates for July and August, eight months' production in 1934 will be 2,296,000, as compared with 1,503,207 for the same period last year. Chevrolet registrations in June exceeded the Ford registrations by less than 100 cars, although for the first six months of 1934 the latter exceeded the former by some 26,000 cars.

The labor situation in assembly plants is not greatly changed from that reported in our last number. A drop of seven per cent in total employment in mid-July over mid-June was reported by the Michigan Department of Labor. With reductions in schedules the August figures will show a greater reduction. The Associated Automobile Workers of America, formed by defections of Olds and Hudson employees from the A. F. of L., is expecting applications from other groups who are dissatisfied with Federation leadership, with the proportion of the dues demanded and with Richard Byrd's representation on the Automotive Labor Board. Three hundred members of a General Motors local in Pontiac voted to join the new group August 16. Some instances of surrender of A.F. of L. charters are reported, and many members, carried into the Federation under the supposition that the industry was to be made a closed shop, are failing to pay dues.

This picture does not by any means indicate that the labor situation in assembly plants is on the way to solution. There are three main groups now competing for the workers' support—the A.F. of L., the A.A.W. and the so-called company unions, with the M.E.S.A. also making a bid for productive workers. The whole situation is full of difficulties and renders more imperative, and also more difficult, a proportional representative plan being developed by the Labor Board.

Little Outside Tool Work

The pattern workers strike, now in its fifth week, will offer some difficulties to new model work unless shortly settled. Demands are $1.50 per hour with closed shop. Reports are that some model work has been let outside Detroit but this is not large, in fact new model preparations are not materializing as fast as expected. Expectations are that the assembly plants will support the jobbing pattern shops as long as new work is not seriously interfered with. It is stated on good authority that no tool work of any consequence has been let outside the Detroit area.

Five of the larger tool and die shops are busy, but some of the contracts awarded have been ordered held up within the last few days. This fact, together with the slow materializing of new programs generally, may be explained partially by the expiration of the automobile manufacturers' code September 4. The merit clause and averaging of hours amendment are the critical points for discussion. The hearing scheduled for August 27th has been postponed for the manufacturers' proposals.

The losses sustained in the first half of the year by several independents and profits lower than anticipated from the volume of business by others, lends fuel to the belief that model changes will be small from the mechanical standpoint. With five dollars difference in car allowance sufficient to swing a sale and fifty dollars difference in price opening up a new potential market of sev-

Exports of Machinery During July, 1934

	July, 1934	June, 1934	July, 1933
Electrical machinery and apparatus	$5,758,896	$5,491,025	$3,150,456
Power generating machinery (except automotive and electric)	618,903	634,316	322,006
Construction and conveying machinery	527,933	417,374	232,181
Mining, well and pumping machinery	2,094,222	2,379,810	780,964
Power-driven, metal-working machinery	1,638,865	1,595,489	465,702
Other metal-working machinery	170,714	196,276	68,826
Textile machinery	1,210,060	549,121	468,889

Exports of Metal-Working Machinery During July, 1934

	July, 1934	June, 1934	July, 1933
Engine lathes	$32,374	$189,114	$11,803
Turret lathes	18,617	113,728	13,157
Other lathes	56,204	82,541	12,228
Vertical boring mills and chucking machines	23,707	71,994	10,045
Thread cutting and automatic screw machines	74,592	145,491	22,135
Knee and column type milling machines	2,898	23,559	6,543
Other milling machines	34,010	137,838	12,741
Gear cutting machines	90,300	140,723	51,336
Vertical drilling machines	7,379	7,229	38,683
Radial drilling machines	1,202	15,297	8,694
Other drilling machines	99,012	63,543	18,008
Planers and shapers	15,244	10,598	1,150
Surface grinding machines	29,267	34,331	4,060
External cylindrical grinding machines	39,369	42,580	3,998
Internal grinding machines	95,972	65,141	12,630
Tool grinding, cutter-grinding and universal grinding machines	55,773	39,756	19,568
Other metal-grinding machines	52,641	33,476	19,624
Sheet and platemetal working machines	130,848	78,574	37,640
Forging machinery	86,113	53,083	34,118
Rolling mill machinery	91,072	42,781	23,913
Foundry and molding equipment	23,021	22,618	11,400
Other power-driven metal-working machinery and parts	578,980	181,494	92,228

Other Metal-Working Machinery

Pneumatic portable tools	$61,191	$66,475	$19,853
Other portable and hand or foot operated metal-working machines and parts	44,106	42,649	17,309
Chucks for machine tools	10,360	11,259	3,920
Machine operated pipe and thread cutters, stocks, dies, taps and other machine operated tools	35,634	42,857	16,320
Other metal-working machine tools	19,423	33,036	11,424

eral hundred thousand, the temptation to reduce the cost of model changes is strong.

The report broadcast last week that knee action front wheels would be abandoned is positively denied by General Motors. This development came initially as a result, not a cause, of intensive study to improve the riding qualities of passenger cars and continued development may be expected along these lines.

Chevrolet on August 8 announced the construction of a new assembly plant in Baltimore to employ 1,500 men when in operation. Fisher Body corporation announced also the budgeting of a $3,000,000 expansion program for all plants in the country with major expenditures centered in Cleveland, Detroit and Pontiac. Large triple-action presses are included in equipment purchases, some of which have been let. This press equipment will permit larger body stampings than have hitherto been the practice. General plant rearrangement is also a part of the program. A $10,000,000 expansion in power plant and auxiliary equipment is to be made at the Ford River Rouge plant as a result of the expansion in steel capacity. Aside from the Fisher program and some request for quotations by Packard for the new car line, inquiries for machine equipment are reported better than in June and July.

E. S. Wallace, formerly manager of the Bay City Chevrolet plant, is made general manager of the Saginaw Steering Gear Division of General Motors. The bumper division of Eaton Manufacturing Co. has been transferred from Cleveland to Jackson, Michigan.

Administration Appoints Code Representatives

Among the recent appointments to code authorities in the metal working field to represent the National Recovery Administration are the following:

Safety razor and safety razor blade manufacturing industry, diesel engine manufacturing industry and the hydraulic machinery industry—Daniel L. Morris, New York attorney, formerly assistant to the United States attorney-general.

Dowel pin manufacturing industry—D. J. Duncan, professor of marketing and management, Northwestern University.

Boat building and boat repairing industry—Saxon W. Holt, former member of the Virginia state senate.

Aluminum industry—Stuart F. Heinritz, formerly on the code advisory staff of the NRA Consumers' Advisory Board.

Navy Awards Contracts for Twenty-Four Warships

Contracts for the construction of 24 warships, 11 from private plants and 13 from Government yards, were awarded on August 22, at a total cost of $53,106,000. Completion of these ships will bring the navy to within 78 vessels of the strength authorized under the London naval treaty. According to present plans, the navy will recommend to the new Congress an additional program for the construction of 14 more destroyers and 5 submarines. This number may be increased if it is apparent next year that the fiscal condition of the Government will justify heavier expendtiures for warcraft.

It is estimated that the work involved in the contracts recently let will give successful bidders and government yards employment for nearly two years, and will aid the steel industry. The awards to private yards were as follows:

Newport News Shipbuilding and Drydock Co., one, 10,000-ton light cruiser.

New York Shipbuilding Corporation, one, 10,000-ton light cruiser.

Federal Shipbulding and Drydock Co., two, 1,850-ton heavy destroyers.

Bethlehem Shipbuilding Corporation, two, 1,500-ton light destroyers.

United Shipbuilding and Drydock Co., two, 1,500-ton light destroyers.

Electric Boat Co., three, 1,300-ton submarines.

According to the law authorizing the construction of these vessels, half of the program was to be built by private builders. Since no single bids had been submitted for destroyers, which came within the limit of costs, an even division could not be made giving 13 vessels to navy yards. With the exception of the one heavy cruiser to be built in the Philadelphia Navy Yard, the ships can be started promptly. According to the London treaty, the keel of the heavy cruiser cannot be laid until January 1, 1935. No awards were made to West Coast yards, although several had submitted lower bids. Acting Secretary Henry L. Roosevelt explained that this was because the West Coast yards had failed to submit bonds. The awards were made with provision for increasing payments if labor and material costs increase.

• INDUSTRIAL REVIEW •

• Based on orders actually closed, the immediate outlook in machinery manufacture is none too promising, but other factors give evidence that the January-August down trend may soon be reversed. The loss of only a fraction of a point in the July tool index from the June figure and the maintenance of about the same lead during August suggests that a bottom has been reached in this industry's activity. Foreign sales have already turned upward.

• Governmental pump priming which has already aided other industries may spread to the metal-working field during the next few weeks if funds are authorized for the proposed rehabilitation of arsenals and navy yards. In addition, the six months' interruption in private re-equipment programs traceable to labor troubles and governmental restrictions may be ended. While the deterring forces are still present their extent and influence is becoming better understood with the probability that the need for new equipment will cause a revival of buying.

• August has been quiet in New England and New York with dealers living on hopes of governmental orders. Inquiries are more plentiful but tangible results await restoration of confidence.

• Pittsburgh still harassed by labor unrest, especially in the Aluminum plants, reports several orders closed for special machinery and a number of active inquiries ready to break. Strikes again threaten Cleveland, with metal-working plants particularly vulnerable. Business there is still at a low ebb. In Cincinnati August orders were slightly better than for July but still can be classed as extremely dull.

• Delayed automobile retooling programs are certain to aid Detroit soon. Sales of special machines and supplies are better, but standard lines are slow. Considerable interest is evident in large press and steel fabricating equipment.

• In comparison with other sections, Chicago is doing well although sales are spotty. However, with the effects of the drought discounted the feeling there is decidedly hopeful. Agitation and strikes spoiled August business in Milwaukee. St. Louis is experiencing a turn for the better.

Machine Tool Orders Hold in July

While continuing the downtrend that has been evident in the machine tool industry since the first of the year, machine tool orders for July showed such a small drop from the preceding month that the decline appears to have been checked. With an index of gross orders for July at 34.7, the industry showed little recession from June when the figure was 35.3 and is still slightly better than a year ago.

Foreign orders improved slightly over June, the index rising to 8.4 from 7.9. As shown by Table II, most of the improvement in foreign business was enjoyed by the larger companies. Group B companies, those whose shipments in 1926 amounted to less than $200,000, do considerably less volume of foreign business in proportion to their total sales than does the A group. In July, for instance, only 5 per cent of the total orders placed with the smaller group were for overseas shipment.

As shown by Table III, the distribution of orders is still bad. Out of 172 companies reporting, only 12 equalled or bettered their 1926 experience; 43 companies reported less than 10 per cent of their 1926 shipments; 69 companies less than 20 per cent, and 98 companies, or more than half those reporting, showed less than 30 per cent.

Foundry Orders Off Sharply in July

With an index of only 50.7, as against 70.4 for June reported by the Foundry Equipment Manufacturers Association, foundry equipment orders for July showed a sharp drop and were only slightly above the index of 48.8 for July, 1933. Shipments at 67.2 were somewhat better than the preceding month when the figure was 64.3 and considerably better than a year ago when the index was 38.3.

Unfilled orders in July at 43.1 showed a decline from the June figure of 57.8, but were above the 35.8 for July, 1933. The three months' moving average at 62.5 compares with 68.3 a month ago, and 39.8 a year ago. The foundry equipment index is based on 1922-24 equalling 100 per cent. Twenty-one members contributed to the July report.

Machinery Concerns Increase First Half Earnings

According to a spot check of corporation earnings of typical machinery manufacturers for six months of 1934, the Machinery and Agricultural Implements Division of the Department of Commerce found evidence of recovery. Of thirteen firms recorded, eight made gains and five losses in the first half of 1934, contrasting with one gain and twelve losses by the same concerns in the first half of 1933.

In terms of dollar value, the five firms showing deficits lost $1,577,000 in 1934, and the eight firms showing gains earned $3,379,000, making a net gain of $1,802,000 for the group. In 1933 the same thirteen firms showed a total loss of $6,337,000 and a gain of $61,000, making the net loss $6,276,000.

Attractive Market Seen for Conditioning Equipment

According to trade reports to the Department of Commerce, a good foreign market for American air-conditioning machinery will probably require but little development. While foreign interest in American equipment for this purpose has so far centered on facilities for industrial use, the encouraging volume of inquiries from abroad, especially from tropical and warm temperate countries, has been swelled by those dealing in home equipment.

Andrew Cruse, chief of the electrical equipment division of the Bureau of Foreign and Domestic Commerce, is planning a questionnaire to the foreign offices covering air-conditioning equipment. He hopes that the survey will develop a picture of world demand of this strictly American development before the end of the winter. Suggestions from the industry as to what should be incorporated in the questionnaire are being sought by Mr. Cruse.

Meanwhile, R. E. W. Harrison, chief of the bureau's machinery division, is seeking information from manufacturers of the heavier industrial air-conditioning equipment in order to answer the inquiries that he is receiving.

Table I—Index of Orders Based on Volume of Shipments for 1926

Month	No. of Reports	Index of Orders: Total	Index of Orders: Domestic	Index of Orders: Foreign	% Foreign to Total Orders
January	163	53.7	43.9	9.8	18
February	163	50.9	40.5	10.4	21
March	163	48.1	40.1	8.0	17
April	163	46.5	36.2	10.3	22
May	160	45.9	35.4	10.5	23
June	166	35.3	27.4	7.9	23
July	172	34.7	26.3	8.4	24

Table II—By Size of Companies

Group A—Companies reporting year's sales in 1926 of $200,000 or more:

Months	No. of Reports	Index: Total	Index: Domestic	Index: Foreign	% Foreign to Total
January	82	54.0	43.5	10.5	19
February	82	50.7	39.5	11.2	22
March	82	47.2	38.8	8.4	18
April	89	46.2	35.3	10.9	24
May	88	45.8	34.6	11.2	25
June	90	35.1	26.8	8.3	24
July	90	34.7	25.8	8.9	26
Group B—Companies reporting year's sales in 1926 of less than $200,000:					
January	81	49.8	48.3	1.5	3
February	81	53.0	50.6	2.4	5
March	81	57.3	54.7	2.6	5
April	74	50.3	48.2	2.1	4
May	72	48.0	46.4	1.6	3
June	76	37.4	33.9	3.5	9
July	82	35.2	33.3	1.9	5

Table III—Indexes of Individual Companies

New Orders in % of 1926 Shipments	Number of Reports in Each Index Group: January	February	March	April	May	June	July
200 or more	7	4	4	6	4	2	3
100–199	14	16	17	15	12	10	9
90–99	8	4	5	4	4	0	2
80–89	7	5	6	3	5	8	3
70–79	4	4	7	2	6	5	2
60–69	5	6	12	5	11	10	12
50–59	5	13	6	19	12	7	8
40–49	20	14	9	19	10	9	13
30–39	14	14	19	17	22	24	22
20–29	22	20	27	20	22	25	29
10–19	27	25	23	22	33	21	26
Less than 10	30	38	28	31	19	45	43
Total reports	163	163	163	163	160	166	172

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
Aug. 29	Carlton Hotel	N. W. Foster	National Steel Partition (Amendments)
Aug. 29	Washington Hotel	Cowling	Locomotive Institute (modification)
Aug. 31	Carlton Hotel	N. W. Foster	Porcelain Enamel Institute (uniform cost finding)
Sept. 5	Carlton Hotel	Dixon	Wood Hat Block Manufacturers (modification)

• PERSONALS •

WILLIAM MILLER, senior vice-president of the Pyle-National Co., Chicago, Ill., manufacturer of railroad supplies, has been elected president, to succeed the late L. H. VILAS.

CHARLES E. WADE, vice president and general manager of the Lakey Foundry & Machine Co., Muskegon, Mich., since June, 1932, has resigned. He was previously assistant to W. R. Angell, president of the Continental Motors Corp., and for three years was general manager of the Jefferson Forge Products Co., Detroit.

FRED C. DOEPKE was elected president of the Wrought Washer Manufacturing Co., Milwaukee, Wis., to fill the vacancy caused by the recent death of his father FRED D. DOEPKE. CHARLES H. DISCH has been reelected vice-president.

LEWIS L. BREDIN has been elected president of the Chamberlin Metal Weather Strip Co., Inc., Detroit. Formerly he was manager of the screen division, and now succeeds to the post held by his late father, CHARLES H. BREDIN.

• OBITUARIES •

WILLIAM C. CHINNECK, 60, superintendent of the American Sterilizer Co., Erie, Pa., died recently.

GEORGE W. CHRISTOPH, SR., founder and president of the Sterling Blower and the Hartford Blower Companies (Connecticut), died August 20.

JAMES L. GOUGH, veteran machine tool dealer, died at Tampa, Florida, on August 20 at the age of 59. Mr. Gough started as a boy at the Niles Tool Works, Hamilton, Ohio. From 1903-11 he was assistant general manager of the Marshall & Huschart Machinery Co., Chicago, leaving that company to go with the Essley Machinery Co. for a short time. Next he organized and was president of the Federal Machinery Sales Co., but retired several years ago because of ill health.

THOMAS DUDLEY WEBB, vice-president of the American Laundry Machinery Co., Cincinnati, Chicago, Rochester and Manhattan, died August 21, at the age of 69.

• BUSINESS ITEMS •

The National Motor Bearing Co., San Francisco, has acquired the factory formerly occupied by the Pacific Coast Division, Victor-R.C.A. Corp., in Oakland, Calif. Production will be started at the new plant about October 1.

Ritterbush & Company, Inc., 30 Church St., New York City, dealers in heavy used manufacturing equipment, have opened an office in the Park Bldg., Pittsburgh, Pa., in charge of Louis Mardaga, who received an M. E. from Lehigh in 1916. C. S. Rogers, graduate mechanical engineer from Tufts, has been added to the New York staff. The company also renders engineering counsel on machinery requirements to industrial plants.

Allis-Chalmers Mfg. Co., Milwaukee, has announced the removal of its Chicago district office to the Field Building, 35 South LaSalle St.

The Dayton Rogers Manufacturing Co., Minneapolis, Minn., has moved to larger quarters at 1845 Franklin St. The company produces metal stampings in small lots.

Made-Rite Appliance Corp., Sandusky, O., has been merged with the Weinig Products Co., 1814 East 40th St., Cleveland. Companies manufacture electric dryers, toasters and curling irons. Negotiations are in progress for purchase of the former Ohio Motor Co., plant in Sandusky where operations of the two concerns will be concentrated.

The Industrial Brown Hoist Corp., Cleveland, a consolidation of the Brown Hoisting Machinery Co., Cleveland, and the Industrial Works, Bay City, Mich., has been granted permission by Federal Judge Arthur J. Tuttle to reorganize under new Federal legislation. The reorganization is designed to thaw out the company's frozen assets. Included in the merged company is the Massillon Foundry & Machine Co., Bedford, Ohio, and a controlling interest in the Portland Concrete Machine Company.

• EXPORT • OPPORTUNITIES

*7661. Lagos, Nigeria. Gold washing machinery, alluvial, portable, hand or gasoline-motor operated.

*7669. Paris, France. Butter molding and packing machines.

*7673. Oruro, Bolivia. Spinning machines of 7,000 to 10,000 spindles, for cotton; and cotton-weaving looms.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

• MEETINGS •

AMERICAN SOCIETY FOR METALS. Annual meeting, Oct. 1-5. Hotel Pennsylvania, N. Y. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

AMERICAN WELDING SOCIETY. Annual meeting, Oct. 1-5. Hotel New Yorker, New York City. Miss M. M. Kelly, Secretary, 29 West 39th Street, New York, N. Y.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION. National conference and convention, September 20-22. Netherlands-Plaza Hotel, Cincinnati. For information address Publicity Headquarters, N.I.A.A. Convention, c/o Union Gas & Electric Co., Publicity Dept., Cincinnati, Ohio.

NATIONAL METAL CONGRESS. Exhibition and program sponsored by the A.S.M., the A.W.S., the Institute of Metals, and Iron & Steel Divisions of American Institute of Mining and Metallurgical Engineers and the Wire Association, October 1-5. W. H. Eisenman, director, 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL SAFETY COUNCIL. Twenty-third annual safety congress and exposition. Oct. 1-5. Hotel Statler, Cleveland, Ohio. National Safety Council, Inc., 20 North Wacker Drive, Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. National production meeting. Oct. 11-12. Book-Cadillac Hotel, Detroit, JOHN A. C. WARNER, manager, 29 West 39th St., New York, N. Y.

CORPORATION • REPORTS •

American Laundry Machinery Co.

Six months, net loss $299,488; first half 1933, net loss $688,527.

American LaFrance & Foamite Corp.

Six months, net loss $57,688; first half, 1933, net loss, $122,425; June quarter, net loss, $60,214; second quarter, 1933, net loss, $72,299.

American Rolling Mill Co.

Six months, net profit $2,018,148; first half, 1933, net loss $659,325; June quarter, net profit $1,472,879; second quarter, 1933, net profit $307,268.

Baldwin Locomotive Works

Twelve months ended June 30, net loss, $3,582,255, same period 1933, net loss, $4,273,983.

Bendix Aviation Corporation

Net profit, six months, $1,515,182; first half, 1933, net profit, $549,386; June quarter, net profit, $756,205; second quarter, 1933, net profit, $816,849.

Borg Warner Corporation

Six months, net profit, $1,950,528; first half, 1933, net profit, $335,172; June quarter, net profit, $1,085,435; June quarter, 1933, $717,153.

Bucyrus Erie Co.

Six months, net loss, $71,168; first half, 1933, net loss $508,335.

Chicago Pneumatic Tool Co.

Six months, net profit $189,800; first half 1933, $275,166; June quarter net profit, $165,039; June quarter 1933, net profit, $24,761.

Chrysler Corporation

Six months, net profit $8,192,084; first half, 1933, $4,747,534; June quarter, net profit $4,888,234; June quarter, 1933, $7,785,616.

Crosley Radio Corporation

June quarter, net profit $340,668; second quarter, 1933, net profit $104,911.

Curtiss-Wright Corporation

Six months, net profit $94,307; first half, 1933, net profit $428,073; June quarter, net profit $299,287; June quarter, 1933, net profit $423,320.

S. R. Dresser Mfg. Co.

Six months, net profit, $29,230; first half 1933, net profit $5,243.

Easy Washing Machine Co.

Six months, net profit, $4,295; first half, 1933, net loss, $61,977.

Electric Controller & Mfg. Co.

Six months, net profit, $53 570; first half, 1933, net loss $109,628.

Federal Screw Works

Six months, net loss, $3,074; first half, 1933, net loss, $137,488; June quarter, net loss, $22,730; second quarter, 1933, net loss, $25,028.

Fairbanks Morse Co.

Net profit, six months, $22,228; first half, 1933, net loss $1,026,250.

Federal Motor Truck Co.

Six months, net profit $37,097; first half 1933, net loss $182,707.

Gabriel Co.

Six months, net loss, $30,298; first half, 1933, net loss $8,442; June quarter, net loss, $5,842; second quarter, 1933, net loss, $20,423.

Gillette Safety Razor Co.

Six months, net profit, $1,966,078; first half, 1933, net profit, $2,232,826; June quarter, 1933, net profit, $1,063,876; June quarter, 1933, net profit, $1,275,048.

Gemmer Manufacturing Co.

Six months, net profit $45,819; first half, 1933, net profit $16,003.

General American Transportation Corp.

Net profit, six months $1,019,521; first half, 1933, net profit $860,000; June quarter, net profit $659,236; second quarter, 1933, net profit $745,708.

General Cable Corporation

Six months, net loss, $240,007; first half, 1933, net loss, $1,588,467; June quarter, net profit, $89,789; second quarter, 1933, net loss, $611,489.

Holland Furnace Co.

June quarter net loss $112,375; June quarter, 1933 net loss $65,081.

Hoskins Manufacturing Co.

Six months, net profit $174,863; first half 1933, net profit $25,256.

Houdaille Hershey Corporation

Six months, net profit, $725,808; first half, 1933, net loss $32,637; June quarter, net profit $475,562; second quarter, 1933, net profit $185,798.

Hupp Motor Car Co.

Six months, net loss $1,479,367; first half 1933, net loss $781,432; June quarter, net loss $736,841; June quarter, 1933 net loss $258,435.

Kelsey Hayes Wheel Corporation

Six months, net profit $465,955; first half, 1933, net loss $302,176; June quarter, net profit $338,652; second quarter, 1933, net profit $61,185.

Lunkenheimer Co.

Six months, net profit $87,988; first half, 1933, net loss $186,349.

Marlin Rockwell Corporation

Six months, net profit $227,264; first half, 1933, net loss $60,500; June quarter, net profit $127,884; second quarter, 1933, $6,704, net loss.

Maytag Co.

Six months, net profit, $1,046,574; first half, 1933, net profit, $76,211; June quarter, net profit, $586,192; second quarter, 1933, net profit, $171,376.

Midland Steel Products

Six months, net profit $293,651; first half 1933, net profit $278,896; June quarter, net profit $222,794; June quarter 1933, net profit $341,800.

Moto Meter Gage & Equipment Corp.

Six months, net profit $368,339; first half, 1933, net profit $16,226; June quarter, net profit $177,500; second quarter, 1933, $74,745, net profit.

National Acme Co.

Net profit, six months, $150,599; first half, 1933, net loss $263,023; June quarter, net profit $92,455; second quarter, 1933, net loss $108,299.

National Enameling & Stamping Co.

Six months, net profit $210,889; first half of 1933, net loss $34,760.

Reo Motor Car Co.

Six months, net loss $506,944; first half, 1933, net loss $762,944; June quarter net loss $234,063; June quarter 1933 net loss $303,699.

Royal Typewriter Co.

Six months net profit, $476,156; first half, 1933, net loss $137,332.

Savage Arms Corporation

Six months, net loss $65,029; first half, 1933, net loss $181,781; June quarter, net profit $17,307; second quarter, 1933, net loss $61,207.

Wright Aeronautical Corporation

Six months net profit $401,293; first half 1933, net profit, $430,481; June quarter, net profit $476,403; June quarter 1933, net profit, $325,097.

Yale & Towne Mfg. Co.

Six months, net profit $62,265; first half, 1933, net loss $189,417; June quarter, net profit $41,011; second quarter, 1933, net loss $82,324.

• PATENTS •

July 24, 1934

Metal-Working Machinery

Head and Column Clamp Interlock. David C. Klausmeyer, deceased, late of Cincinnati, O. Assigned to the Cincinnati-Bickford Tool Co. Patent 1,967,409.

Press. Arthur A. Byerlein, Detroit, Mich. Assigned to General Machinery Corp., Hamilton, O. Patent 1,967, 464.

Cam Controlled Multispindle Machine. Lawrence Lee Schauer and Augustus Marius Sosa, Cincinnati, O. Assigned to The Cincinnati-Bickford Tool Co. Patent 1,967,689.

Milling Machine. Joseph B. Armitage, Wauwatosa, Wis. Assigned to Kearney & Trecker Corp. Patent 1,967,733.

Tools and Attachments

Universal Multiple Drill Head. Anton A. Herzberg, Waukesha, Wis. Patent 1,967,307.

Processes

Method of Forming and Treating Axles. Edmund C. Mogford and George Spatta, Buchanan, Mich. Assigned to Clark Equipment Co. Patent 1,867,317

July 31, 1934

Metal-Working Machinery

Channel Bending Machine. David C. Bailey, Amesbury, Mass. Patent 1,968,010.

Welding Machine. Le Roy H. Hoffer, Brooklyn, N. Y., assigned to Metropolitan Engineering Co. Patent 1,968,079.

Machine for Shaping Bar Ends and Work End Finishing Purposes. John M. Nash, Wauwatosa, Wis. Patent 1,968,091.

Roll Grinding Machine. Richard C. Lewis, and Gunnar V. Hultgren, New Haven, Conn., assigned to Farrel-Birmingham Co., Inc. Patent 1,968,255.

Milling Machine Transmission and Control. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,968,276.

Discharging Mechanism on Forming Machines. John H. Moore, Detroit, Mich., assigned to Andrew Ruen Hanger Co. Inc. Patent 1,968,305.

Garment Hanger Forming Machine. John H. Moore, Detroit, Mich., assigned to Andrew Ruen Hanger Co., Inc. Patent 1,968,306.

Feeding and Clamping Mechanism. John H. Moore, Detroit, Mich., assigned to Andrew Ruen Hanger Co., Inc. Patent 1,968,307.

Machine for Forming Metal Wool Into Pads. Levander Peterson, Chicago, Ill., assigned to James H. Rhodes & Co. Patent 1,968,310.

Cutting, Setting and Sharpening Saws. Erich Poeggel, Renscheid, Germany. Patent 1,968,352.

Gear Shaper. Oliver G. Simmons, Lakewood, Ohio, assigned to M. Gloyd.

Die Shaping Machine. Ferdinand Brustle, Nutley, N. J., assigned to Victor C. Thorne. Patent 1,968,514.

Tool Carrier for Multiple Spindle Screw Machines. Harry W. Rupple, Cleveland, Ohio, assigned to The Cleveland Automatic Machine Co. Patent 1,968,538.

Hydraulic Press. Allen F. Beck, Columbus, Ohio, assigned to The Clark Grave Vault Co. Patent 1,968,595.

Method and Machine for Producing Springs. George G. Powers and Clarence A. Rhinevault, Chicago, Ill., assigned to The Powers Spring Corporation. Patent 1,968,802.

Tools and Attachments

Drill. John H. Phillips, Chicago, Ill. Patent 1,968,055.

Tap. Robert Thomson, Arlington, N. J., assigned to Dardelet Threadlock. Corp. Patent 1,968,103.

Kick-Out for Metal-Working Machines. William L. Clouse, Tiffin, Onio, assigned to The National Machinery Co. Patent 1,968,128.

Tool for Cleaning Commutators and the Like. Norris F. McNaught and Edward H. Peterson, Chicago, Ill., assigned to Duro Metal Products Co Patent 1,968,215.

Metal Spraying Apparatus. Donald D. Taylor, Duncannon, Pa., assigned to Advance Engineering Corp. Patent 1,968,329.

Calipers. Byron Bartell Wittfoht, Bartonville, Ill. Patent 1,968,331.

Piston Ring Chuck. Charles E. Johnson, North Muskegon, Mich., assigned to Sealed Power Corp. Patent 1,968,400.

Work Feeding Mechanism. Hubert E. Dickermann, Springfield, Mass. Patent 1,968,479.

Bending Device for Metallic Tubes and the Like. Albert Hossfeld, Winona, Minn. Patent 1,968,645.

Means for Regrooving Spindle Whorls. Walter C. Stewart, Gastonia, N. C. Patent 1,968,721.

Processes

Plating Aluminum and Its Alloys. Johannes Fischer, Berlin-Charlottenburg, Germany, assigned to Siemens & Halske. Patent 1,968,483.

Process of Preparing, Grinding, or Polishing Tools. Ernst Elbel and Otto Sussenguth, Erkner, Germany. Patent 1,968,799.

American Machinist
REFERENCE BOOK SHEET ©

Standard Jig Bushings

The proposed "American Standard for Jig Bushings" reproduced on this page and the following page has been approved by the Sectional Committee on Standardization of Small Tools and Machine Tool Elements, the American Society of Mechanical Engineers. The standard is sponsored also by the National Machine Tool Builders' Association and the Society of Automotive Engineers, and will be promulgated shortly by the American Standards Association.

Nomenclature

PRESS FIT BUSHINGS. Press fit wearing bushings to guide the tool are for installation directly in the jig without the use of a liner and are employed principally where the bushings are used for short production runs and will not require replacement. They are also intended for use where the closeness of the center distance of holes will not permit the installation of liners and renewable bushings. Press fit bushings are made in two types, with heads and without.

RENEWABLE BUSHINGS. Renewable wearing bushings to guide the tool are for use in liners which in turn are installed in the jig. They are used where the bushing will wear out or become obsolete before the jig or where several bushings are to be interchangeable in one hole. Renewable wearing bushings are divided into two classes, "Plain" and "Slip."

Plain renewable bushings are installed in the liner with the intention of leaving them in place until worn out.

Slip renewable bushings are interchangeable in a given size of liner and, to facilitite removal, they are usually made with a knurled head. They are most frequently used where two or more operations requiring different inside diameters are performed in a single jig, such as where drilling is followed by reaming, tapping, spot facing, counterboring, or some other secondary operation.

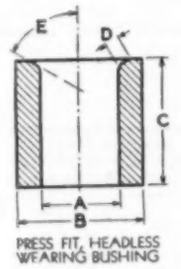
LINER BUSHINGS. Liner bushings are provided with and without heads and are permanently installed in a jig to receive the renewable wearing bushings. They are often called "master bushings."

BUSHINGS SPECIFICATIONS. The dimensions and tolerances of jig bushings shall conform to the specifications given in the following tables and notes.

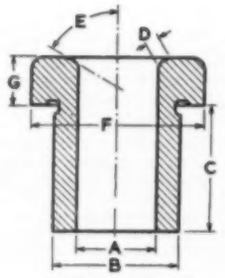
JIG PLATE THICKNESS. The standard lengths of jig bushings as established are based on standardized or uniform jig plate thicknesses of 5/16, ½, ¾, 1, 1⅜ and 1¾ inches.

Table 1 Press Fit Wearing Bushings—Headless and Head Types

Range of Hole[1,2] Size A		Body Diameter[3] B			Length[5] C			Width of Chamfer[4,7] D	Head[6] Diameter F		Head[6] Height G	
From	Up to and Including	Nominal	Max	Min	Short	Medium	Long		Max	Min	Max	Min
0.0000	1/16	5/32	0.176	0.171	5/16		1/2	1/32	1/4	7/32	3/32	3/32
0.0650	5/64	13/64	0.223	0.218	5/16		1/2	1/32	5/16	9/32	3/32	3/32
0.0810	1/8	1/4	0.270	0.265	5/16		1/2	1/32	3/8	5/16	3/32	3/32
0.1290	5/32	5/16	0.333	0.328	5/16	1/2	3/4	1/32	9/16	7/16	1/4	1/8
0 1610	5/16	1/2	0 520	0 515	5/16	1/2	3/4	5/64	13/16	5/8	1/4	7/32
0.3160	1/2	3/4	0.770	0 765	1/2	3/4	1 —	7/64	1 1/16	15/16	1/4	7/32
33/64	3/4	1 —	1.020	1 015	3/4	1 —	1 3/8	7/64	1 7/16	1 1/4	3/8	5/16
49/64	1 —	1 3/8	1.395	1.390	3/4	1 —	1 3/8	9/64	1 13/16	1 5/8	3/8	3/8
1 1/64	1 3/8	1 3/4	1.770	1.765	1 —	1 3/8	1 3/4	9/64	2 5/16	2 —	3/8	3/8
1 25/64	1 3/4	2 1/4	2.270	2 265	1 —	1 3/8	1 3/4	7/32	2 13/16	2 1/2	3/8	3/8



PRESS FIT, HEADLESS WEARING BUSHING



PRESS FIT, HEAD TYPE WEARING BUSHING

All dimensions given in inches

[1] Hole sizes are in accordance with the proposed American Standard for Twist Drill Sizes

[2] The maximum and minimum values of the hole size, A, shall be as follows

Nominal Size of Hole	Maximum	Minimum
Above 0.0000 to 1/4 in. incl	Nominal +0 0004 in	Nominal +0 0001 in
Above 1/4 to 3/4 in. incl	Nominal +0 0005 in	Nominal +0 0001 in
Above 3/4 to 1 1/2 in incl	Nominal +0 0006 in	Nominal +0 0002 in
Above 1 1/2	Nominal +0 0007 in	Nominal +0 0003 in

[3] The minimum body diameter, B, is 0.015 to 0.020 in larger than the nominal diameter in order to provide grinding stock for fitting to jig plate holes

[4] Tolerance on fractional dimensions where not otherwise specified shall be ±0.010 inch

[5] The length, C, is the overall length for the headless type and the length underhead for the head type

[6] The head design shall be in accordance with the manufacturer's practice within the limits of diameter and thickness indicated

[7] The angle of chamfer, E, shall be 59 deg ± 1 deg and a slight radius shall be provided at the intersection of this chamfer with the hole, A

Standard Jig Bushings

Table 2 Renewable Wearing Bushings—Slip and Plain Types

Range of Hole[1,2] Size A		Body Diameter B			Length[4,9] C			Width of Chamfer[5,6] D	Head[8] Diameter F	
From	Up to and Including	Nominal	Max	Min	Short[3]	Medium[3]	Long[3]		Max	Min
0.0000	5/32	5/16	0 3125	0.3123	5/16	1/2	3/4	1/32	5/8	17/32
0.1610	5/16	1/2	0.5000	0 4998	5/16	1/2	3/4	5/64	13/16	25/32
0.3160	1/2	3/4	0 7500	0 7498	1/2	3/4	1 —	7/64	1 1/4	1 1/32
33/64	3/4	1 —	1.0000	0.9998	3/4	1 —	1 3/8	7/64	1 5/8	1 13/32
49/64	1 —	1 3/8	1.3750	1.3747	3/4	1 —	1 3/8	9/64	2 —	1 25/32
1 1/64	1 3/8	1 3/4	1.7500	1.7497	1 —	1 3/8	1 3/4	9/64	2 1/2	2 9/32
1 25/64	1 3/4	2 1/4	2.2500	2 2496	1 —	1 3/8	1 3/4	7/32	3 —	2 25/32

All dimensions given in inches.

[1] Hole sizes are in accordance with the proposed American Standard for Twist Drill Sizes

[2] The maximum and minimum values of hole size, A, shall be as follows:

Nominal Size of Hole	Maximum	Minimum
Above 0.0000 to 1/4 in. incl	Nominal +0.0004 in	Nominal +0.0001 in.
Above 1/4 to 3/4 in. incl	Nominal +0.0005 in.	Nominal +0 0001 in
Above 3/4 to 1 1/2 in. incl	Nominal +0.0006 in.	Nominal +0.0002 in.
Above 1 1/2	Nominal +0.0007 in.	Nominal +0 0003 in.

[3] Tolerance on fractional dimensions where not otherwise specified shall be ±0 010 inch

[4] The length, C, is the length under head for both slip and plain types.

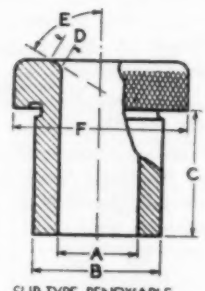
[5] The head design shall be in accordance with the manufacturer's practice within the limits of diameter specified.

[6] The angle of chamfer, E, shall be 59 deg ± 1 deg and a slight radius shall be provided at the intersection of this chamfer with the hole, A.

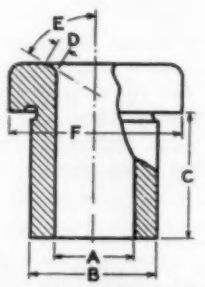
[7] Head of slip type is usually knurled.

[8] Head on plain type is designed for the various locking or holding means.

[9] When renewable wearing bushings are to be used with liner bushings of the head type, the length under head, C (Table 2), should be increased in each case by the thickness of the liner bushing head.



SLIP TYPE, RENEWABLE WEARING BUSHING



PLAIN TYPE, RENEWABLE WEARING BUSHING

Table 3 Liner Bushings—Headless and Head[6] Type

Range of Hole Size in Renewable Wearing Bushings[1]		Inside Diameter A′			Body Diameter[2] B′			Length[4] C′			Head[5] Diameter F	
From	Up to and Including	Nominal	Max	Min	Nominal	Max	Min	Short[3]	Medium[3]	Long[3]	Max	Min
0.0000	5/32	5/16	0.3129	0.3126	1/2	0 520	0.515	5/16	1/2	3/4	5/8	17/32
0.1610	5/16	1/2	0.5005	0.5002	3/4	0.770	0.765	5/16	1/2	3/4	13/16	25/32
0.3160	1/2	3/4	0.7506	0 7503	1 —	1.020	1.015	1/2	3/4	1 —	1 1/4	1 1/32
33/64	3/4	1 —	1.0007	1.0004	1 3/8	1.395	1.390	3/4	1 —	1 3/8	1 5/8	1 13/32
49/64	1 —	1 3/8	1.3760	1.3756	1 3/4	1.770	1.765	3/4	1 —	1 3/8	2 —	1 25/32
1 1/64	1 3/8	1 3/4	1.7512	1.7508	2 1/4	2.270	2.265	1 —	1 3/8	1 3/4	2 1/2	2 9/32
1 25/64	1 3/4	2 1/4	2.2515	2.2510	2 3/4	2.770	2.765	1 —	1 3/8	1 3/4	3 —	2 25/32

All dimensions given in inches.

[1] For detail dimensions of renewable wearing bushings see Table 2.

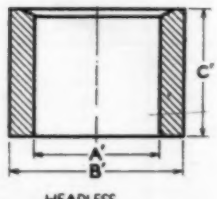
[2] The minimum body diameter, B′, is 0.15 to 0.020 in. larger than the nominal diameter in order to provide grinding stock for fitting to jig plate holes.

[3] Tolerance on fractional dimensions where not otherwise specified shall be ±0 010 inch.

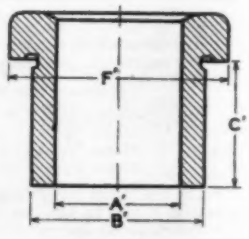
[4] The length, C′, is the overall length for the headless type and the length under head for the head type

[5] The head design shall be in accordance with the manufacturer's practice within the limits of diameter specified

[6] When renewable wearing bushings are to be used with liner bushings of the head type, the length under head, C (Table 2), should be increased in each case by the thickness of the liner bushing head.



HEADLESS LINER BUSHING



HEAD TYPE LINER BUSHING

What Tools Really Cost

ARTHUR HEDBERG

THERE is a lot of misunderstanding regarding the cost of making dies, jigs, fixtures and special tools. Many shops that "roll their own" deceive themselves as to what the real costs are. This is usually unintentional on the part of management, but not always in the case of the head of a "captive" toolroom, who wants to build up a big department and entrench himself in his poistion. The usual excuse for "building your own" is that it saves money. To anyone familiar with the actual conditions, this would be laughable, if it were not so serious to the independent industry.

Peaks and Valleys

It is very difficult to prevent such a department from becoming an old soldiers' home. How can departments which normally employ 40 to 75 men retain any semblance of efficiency when the working force is increased in some cases as much as 400 to 500 men for two or three months out of the year? If they have the personnel and equipment to work efficiently a force of 400 to 500, they are over-equipped and overmanned the balance of the year. On the other hand, if they have only the necessary amount of equipment and personnel to operate and manage normally 40 or 75 men, they are tremendously handicapped during the two or three months of tooling up. This is often the case, and there are countless examples of such condition throughout the industry, particularly in the larger corporations. How are we to achieve stability in employment if some of our foremost corporations and supposedly enthusiastic endorsers of the National recovery program pursue a policy wherein they create and perpetuate departments, so-called "captive" departments or companies (this same condition can be duplicated in the pattern-making industries, printing industry, construction industry, gage industry, etc.), that for a bare two or three months out of the year employ hundreds of workers, who are laid off during the balance of the year? The men let out immediately tend to become a burden on the community and a prey to all types of social disorder.

Before the adoption of this policy by most large companies ten to fifteen years ago, the independent tool and die manufacturer was able to employ a comparatively stable number of workmen throughout the entire year. The reason was that about the time the automotive industry completed their tooling up, the refrigerator, or some other industry was ready to tool up, and so on with different lines throughout the year. Thus, by doing the tool work of a variety of industries, the demand for tool work was staggered throughout the year and toolmakers were employed almost continuously. These men took pride in their plant and workmanship, and developed a laudable sense of loyalty and initiative that cannot be achieved in any other maner. At present, largely as the result of the conditions created by the captive tool shop policy, toolmaking as a craft has been abused and greatly harmed and retarded.

Everyone who has ever worked in a large plant knows something of the way costs can be manipulated to make the desired showing in certain departments. Here is how the practice looks to an independent outsider who competes with the "captive" toolrooms of his customers

As to the efficiency of the captive tool room, it is extremely difficult to check the facts of the case. Some of our friends have been good enough to explain to us how the work is handled in some cases, and how the estimates are met. Frequently the department which is going to do the work makes the original estimates as far as cost is concerned, and since it knows it is going to do the work, it makes the estimates high enough not only to cover the job, but to be able to show a saving—let's say a "synthetic" saving—to the management. Suppose, however, there is a threat of running over on certain jobs. It is common practice then to switch time to another job on which there is going to be a surplus of hours left under the estimate.

Dumping the Overruns

If this cannot be done there is still the account for maintenance work. Ordinarily, it is impractical to place a fair estimate on maintenance work. The estimate, if placed on it at all, must be very definitely on the high side, to be safe. As a result, there is usually a surplus of hours over the estimate. As a matter of fact, many attempt no estimate on maintenance and here is the chance to make all estimated jobs come out right. The result is that the maintenance account becomes a dumping ground to which are transferred all excessive hours which ordinarily would make new jobs exceed their estimates. The executive in charge of that particular department naturally wants to hang on to his job. And there is practically no way of checking it up. In the independent shop, where every job is done for the outside, there is no need and less oportunity for such practice. It would gain little in the long run as all hours must eventually come out of jobs done for the outside. And all of these are estimated, and on competitive terms.

Another explanation for the over-expansion of some captive toolrooms is the desire of the individuals in charge to increase their own importance in the organization and naturally their own incomes. This has been a tremendous spur in driving them to enlarge and expand their departments, and usually, since the managing executives of the corporation are familiar mainly with the selling, distribution and general production problems, the result is that the captive tool and die department receives little attention and is given pretty much its own way.

One of the ridiculous reasons given for

the over-expansion of these toolrooms is the claim that it is not possible to get the tools on the outside. Barring a strike, (and in that case no one is immune, least of all a captive toolroom) there is no reason for a statement that tools cannot be secured on the outside. I know of no legitimate tool and die manufacturer of good repute who is not more than willing to work with any manufacturer of equally good repute, in planning to take care of a certain amount of his tool work annually on a competitive basis. Of course, so long as some purchasing departments have the fanciful sway which they have been permitted to acquire in some companies, there is bound to be some friction. I say this with no general indictment of purchasing departments, but refer merely to the extremes to which purchasing policies have been carried, in some purchasing departments.

Wants Can Be Met

So long as those few are permitted to develop an absurd situation of cut-throat competition, beyond all rhyme or reason, just so long will the manufacturer have occasionally to "pay the piper" or find himself caught as far as sources on tool work are concerned. Let any manufacturer who feels that because of delivery dates or lack of proper available sources he is forced to manufacture his own tools and dies make his wants known, and any number of tool and die sources would be glad to furnish him all the facilities he requires throughout the year on a competitive basis.

The matter of true costs deserves careful consideration. I have had more than one operator of captive tool and die departments say, "we have the building, the space and the equipment and it doesn't cost us anything now we have it. And of course as we have a master mechanic anyway for our normal maintenance and changes during the year, we might just as well have the rest of the big toolroom." Further than that, they did not see why they should charge anything but the overhead of the immediate personel concerned to the department. The main plant would have to have a general manager anyway, with all his assistants, whether they had a big toolroom or not, therefore no part of the general manager's salary should be charged to the toolroom expense. This same reasoning is used for not including many other items in the normal general expense in the business.

As a matter of fact, there is just as much reason for including in tool and die department overhead a portion of the general manager's salary, of the insurance expense, and all the normal general expenses, as there is for including them in the overhead of any other department, since the same arguments could be used individually in the case of each department. Just why they should feel that the tool and die department should not share the general expense of the business in figuring costs, is beyond reasonable comprehension. It does, however, illustrate the degree to which self-delusion can be carried. If they have sufficient supervision to handle 400 to 600 men for two or three months they must be over-manned the balance of the year.

Manufacturing plants that insist on "rolling their own" on tool and die work, foster an unsound, uneconomic set-up not only from the standpoint of the concerns involved, but from the standpoint of the country's welfare. It is rather a sad commentary that this country requires the N.R.A., since all it is trying to accomplish is a reasonable application of the spirit of fair play. However, since it was and is necessary that the Federal Government outline for all of us the application of fair play to business, it seems to many of us in the tool and die industry that a policy might be developed wherein all companies, regardless of size, should be discouraged from maintaining captive departments or subsidiary companies wherein employment will fluctuate widely.

It is unwise and unsocial to increase the force in these departments abnormally for temporary periods of two or three months. This practice creates an acute labor situation during that period, with the resulting harmful unemployment conditions in surplus of that labor immediately upon their discharge.

Any progress in overcoming or curbing this type of captive expansion would immediately react to the benefit of at least one substantial portion of the durable goods industry. What incentive is there to the tool and die manufacturer to increase his investment in machine tool equipment when an increasingly popular but selfish policy on the part of many concerns continues to encroach on his market and to reduce the potential available amount of business for that equipment? It is a subject which has deserved serious attention for a long time but has received comparatively little because this industry has been relatively inarticulate.

Sine Bars and Their Uses

MATTHEW HARRIS

A SINE BAR is essentially a parallel bar having hardened and ground disks near its ends, as in Fig. 1. It must be accurate in all dimensions, and the disks must be of the same diameter and set at the same distance from the edges of the bar. The center distance of the disks is usually either 5 or 10 in., 10 in. being preferred for ease of making the necessary calculations.

The sine bar is used for laying out, setting and checking angles. It is more accurate than a vernier protractor, since angles of less than 1 min. of arc can be determined by it, whereas but few vernier protractors can be set closer than 5 min. of arc. The nominal length of the sine bar is the distance between the centers of the disks which also represents one side of the angle to which it is set.

In use, the disk at one end rests on a true surface and the opposite end of the bar is raised, either by placing gage blocks under the disk at that end or by measuring the height of the under side of the disk by a vernier height gage or an inside micrometer. In setting the sine bar to a predetermined angle, the distance one end is to be raised is equal to the sine of that angle multiplied by the nominal length of the sine bar. The sine of the required angle can be found in all tables of trigonometric functions. If the nominal length of the sine bar is 10 in., then the sine must be multiplied by ten to find the height to which the under side of the disk at one end must be raised. In *American Machinist's Handbook* are tables of sines multiplied by ten, so that the distance to raise the under side of the disk at one end to set a 10-in. sine bar to a predetermined angle can be found without calculation.

If the work on which angular lines are to be laid out is large, a parallel can be clamped directly to it to serve both as a base line and a ledge for the sine bar. If the work is of medium size, it can be laid on a surface plate having a parallel clamped at or near its lower edge to serve as a base line for both the work and the sine bar. But if the work is comparatively small, it can be clamped to a block, as in Fig. 2. The block rests on a surface plate, and the sine bar is set to the required angle and clamped to the block. The work

rests on the upper edge of the sine bar and is also clamped to the block. The angular part of the work is now horizontal and the angular layout line can be scribed upon it with either a surface gage or a height gage having a scriber attached to the sliding head.

Assume that a die-block of medium size is to be laid out for a triangular opening of 30 deg., as in Fig. 3. The sine of 30 deg. is 0.500. If a 10-in. sine bar is used, the sine must be multiplied by ten, equaling 5 in., which is the distance to which the under side of the disk at one end of the sine bar is to be raised.

The above examples illustrate the basic principle of using the sine bar. To cover all the details of its use would require more space than can be allotted to this article. However, knowing the basic principle, the ingenuity of the toolmaker will lead him to apply the sine bare to specific cases.

The use of the sine-bar principle is not restricted to the sine bar as a separate tool. It can be built into various fixtures for machining angular work direct from the setting. In Fig. 4 is shown an angle plate in which disks have been set in pockets milled in a jig borer. It is set to any angle in the same way as is a sine bar and is used to machine work held at an angle to the table travel.

In Fig. 5 is illustrated a magnetic chuck into which the principle of the sine bar has been incorporated. The chuck is used on a surface grinder and is pivoted at one end. The opposite end is provided with two hardened and ground pins, one at each side, and in the base under the pins are hardened and ground pads. In setting the chuck to the required angle, gage blocks of the correct height are placed on the pads and under the pins at *A* and *B*, raising one end of the chuck so that the face is at the required angle. The weight of the chuck is sufficient to hold the raised end down on the gage blocks without clamping.

The angle plate and the magnetic chuck with the sine bars built in have been in use in the plant of the Pratt & Whitney Co. for many years.

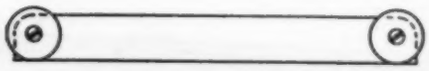


Fig. 1—A typical sine bar has hardened and ground disks of the same diameter attached near the ends at known center distance

Fig. 2—Work clamped to this block and resting on the upper edge of the sine bar can have angular layout lines scribed on it with a surface gage

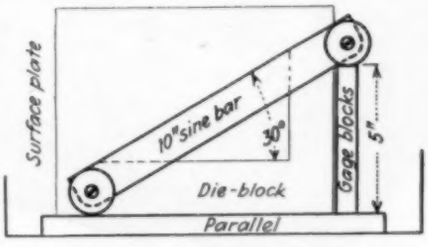


Fig. 3—The correct height to raise one end of the sine bar can be found by multiplying the sine of the angle by the nominal length of the sine bar

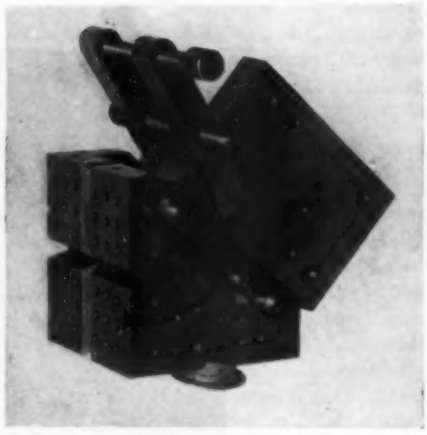


Fig. 4—This angle plate has hardened and ground disks set in pockets. It can be set to a predetermined angle by the same means used in setting a sine bar

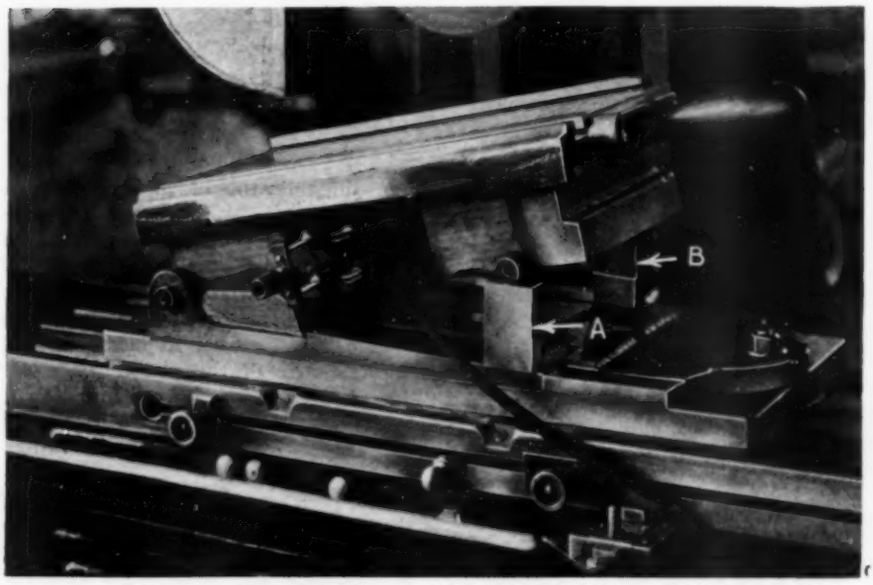


Fig. 5—The sine-bar principle is incorporated in this magnetic chuck. The chuck is pivoted at one end and the opposite end is raised by gage blocks placed under hardened and ground pins

Rust—Prevention and Removal

Rust, to use the common designation of unwelcome spots or coating on iron and steel, is always waiting to get in its objectionable work. How to prevent it or to remove it after it is formed, is a real problem in most shops. In the old days we slushed finished surfaces with a mixture of lard oil or kerosene and white lead. It prevented rust but was a nuisance to remove. Heavy oils, light greases, waxey materials and even special paint-like mixtures have been used. Now we seem to have settled on lanoline (wool fat) base mixtures. Removing rust is a different and tougher problem. Whether removed mechanically or chemically its effect on the surface beneath is frequently of vital importance. The chemist who can fudge up some mixture to brush over a rusted surface and restore it to its former size, shape and previous condition of aptitude, ought to have a real halo.

This punch and die was used for punching 855 holes in a voting machine panel even though many of the holes were smaller in diameter than the thickness of the stock

Successful Piercing With Interchangeable Punches

C. C. RICHARD
President, Allied Products Corporation, Richard Brothers Division

DESIGNING and building a die for piercing 855 holes simultaneously in hard cold-rolled steel, 13½ in. wide, 36 in. long and ⅛ in. thick, demands experience. The die illustrated was designed and built recently by our company to replace one that had failed in service. Its success is attributable to competent engineering, a high degree of accuracy in workmanship, and the incorporation of the interchangeable punches which we have made for many years.

The perforated plate is an important part in an automatic voting machine and must be highly accurate. Before hardening, the dimensions between centers on the entire job checked within 0.001 in. After hardening, the maximum discrepancy was found to be only 0.003 in.

Failure of the old die may have been caused by any one, or several, of the usual shortcomings of complicated perforating dies. The most serious of these is inadequate engineering. In addition there are improper clearance between punch and die; inadequate rigidity brought about by improper proportioning of parts to withstand distortion and maintain alignment, or by the use of the wrong materials in the die shoe and punch block; improper original alignment of punches and dies. In so intricate a die as this one it is particularly important that every one of the faults be avoided.

Another fact worth mentioning is that approximately 100 of the holes to be punched in the ⅛ in. plate are only 3/32 in. in diameter. Even a short time ago it would have been considered impractical to attempt to pierce a hole through ordinary steel using a punch with a point smaller in diameter than the thickness of the plate. Since our interchangeable punches were developed, however, it has been done a number of times on a wide range of dies for various industries.

The pressure required to pierce all of the 855 holes simultaneously can vary as much as 50 per cent with differences in clearance and shear. For instance, the pressure required to force one of the 3/32-in. punches through the ⅛-in. plate measured by actual test in a

Tinius Olsen testing machine, varies from 1,400 to 1,800 lb. with differences in clearance alone. It is obvious, therefore, that determination of the proper clearance may reduce the pressure required to pierce the hole by at least 20 per cent. This reduction adds appreciably to the length of life of the smaller punches.

Even so, as production proceeds the punches wear, and eventually, they start to break. Here is where interchangeable punches become most valuable. The operator can replace a broken punch, when necessary, in a matter of one or two minutes, without noticeable delay in production and with negligible maintenance expense.

The die under consideration is equipped with a full floating, positive stripper, designed with ample clearance around the punch points to obviate cramping either of the punch or the work, both of which would cause breakage. This stripper floats freely and moves upward $\frac{3}{8}$ in. before coming in contact with a series of bolt heads that cause the part to be stripped positively. This feature, combined with the proper back clearance on the punches themselves, creates an ideal stripping condition which requires little pressure. In fact, the weight of the stripper plate alone, in this case, almost overcomes all the pressure required for stripping.

The dies incorporated in this combination unit were made with a perfectly straight hole for a distance down from the top equal to one and one-half times the thickness of the metal, in order to prevent any slugs from returning to the top of the die. The die shoe was machined from a solid 0.40 carbon steel forging, finished 8 in. thick over all, and 6 in. thick over the bridge. A slot 2 in. deep was planed in the bottom to permit the operator to clean slugs from the press bolster. The punch block was forged from the same material and finished to a thickness of 4 in. The reason for using such material in both punch block and die shoe is to insure rigidity, and to assure the user that the die will maintain the accuracy built into it regardless of abuses to which it may be subjected.

The critical factor in this particular die is the interchangeability of the punches. In work where such dies are used, continuity of production is usually of paramount importance. If a die as complicated as this one had to be removed from the press and disassembled to remove a broken punch, then reassembled and the alignment carefully checked, and finally replaced in the press and checked once more to be sure that alignment was still satisfactory, the loss of time would be considerable. At the same time there would be the possible delay all along the production line, the breaking down of schedules and the resultant added cost. All of these drawbacks are eliminated, or practically so, by the use of the interchangeable punch.

Chromium Plate for Tools and Dies

CHROMIUM is placed on a die or a fixture in order to make use of what might be termed certain inherent surface properties of the metal and not for the purpose of adding to the mechanical strength. That mechanical strength must be built into the die first, should be evident when one considers that the chromium deposit on such tools is rarely more than 0.003 in. thick and oftentimes half of this amount or less. On dies in particular, chromium cannot be expected to take the place of heat-treatment.

The coefficient of friction of chromium is from one-half to two-thirds that of steel when tested against steel. This means that a piece of metal being acted on in a die will slide over the chromium surface more easily, and with less strain on the die, than there would be if the die had a steel surface. Under certain conditions the power required for a given operation, when using a chromium plated die, may be less than when using an unplated steel die.

The so-called hardness of chromium has been measured in various ways. For the present purpose, it is safe to say that the scratch hardness and Brinell hardness of chromium, properly applied, is greater than that of practically all hardened steels used commercially. However, with the thicknesses normally applied when chromium plating dies, the additional hardness of chromium will not be of much use unless the metal under the chromium is hard enough to back the chromium up properly.

Then there is a property of chromium for which there is no simple name. It is the resistance to galling and scoring shown by a chromium plated surface. A chromium-plated drift pin, for instance, does not score or pick up metal the way a steel pin will often do.

Another property is abrasion resistance. This is not easy to define. It can be said that the combination of slipperiness and hardness, which is characteristic of chromium plated surfaces, offers definite advantages over steel when subjected to conditions of severe abrasion.

Resists Scoring

If one considers the action on the surface of a die when metal parts are formed or drawn, it will be apparent that of two dies of equal mechanical strength, the one whose surface presents the least resistance to friction or abrasion, or scoring or galling, will be the one that will give the longest life consistent with satisfactory quality. Under some conditions, this extra life will also be accomplished at a saving in power costs. Since these are just the properties in which chromium excels, the problem of the die designer and builder is to make a die so that full advantages may be taken of these properties.

First of all, the die should be mechanically strong enough to resist deformation without chromium plating, as otherwise chromium plating will be a disappointment. Next, sharp edges and corners both exterior and interior should be avoided as far as possible, since they increase the cost of plating and often present a point of weakness in the plated die. Frequently $\frac{1}{4}$ in. radius instead of a sharp corner will help; larger radii are even better.

To obtain the full benefits of chromium plating, the surfaces prior to plating should be really smooth without being burnished. Such tool marks as are left on the surface should, if possible, be parallel to the direction of movement of stock.

Choose a source for your plating which has a competent technical management and is properly equipped to handle this type of plating. Give the plater full information regarding the composition and heat-treatment of the metal used in making the die and the manner in which the die will be used in service. The plater will then be in a better position to do a first-class plating job with assurance that the chromium will adhere to the base metal and be of the thickness which experience has shown to give best results for the service expected. Plating tools and dies is a field that is distinct and separate from ordinary decorative plating. It requires special experience and skill to turn out satisfactory work.

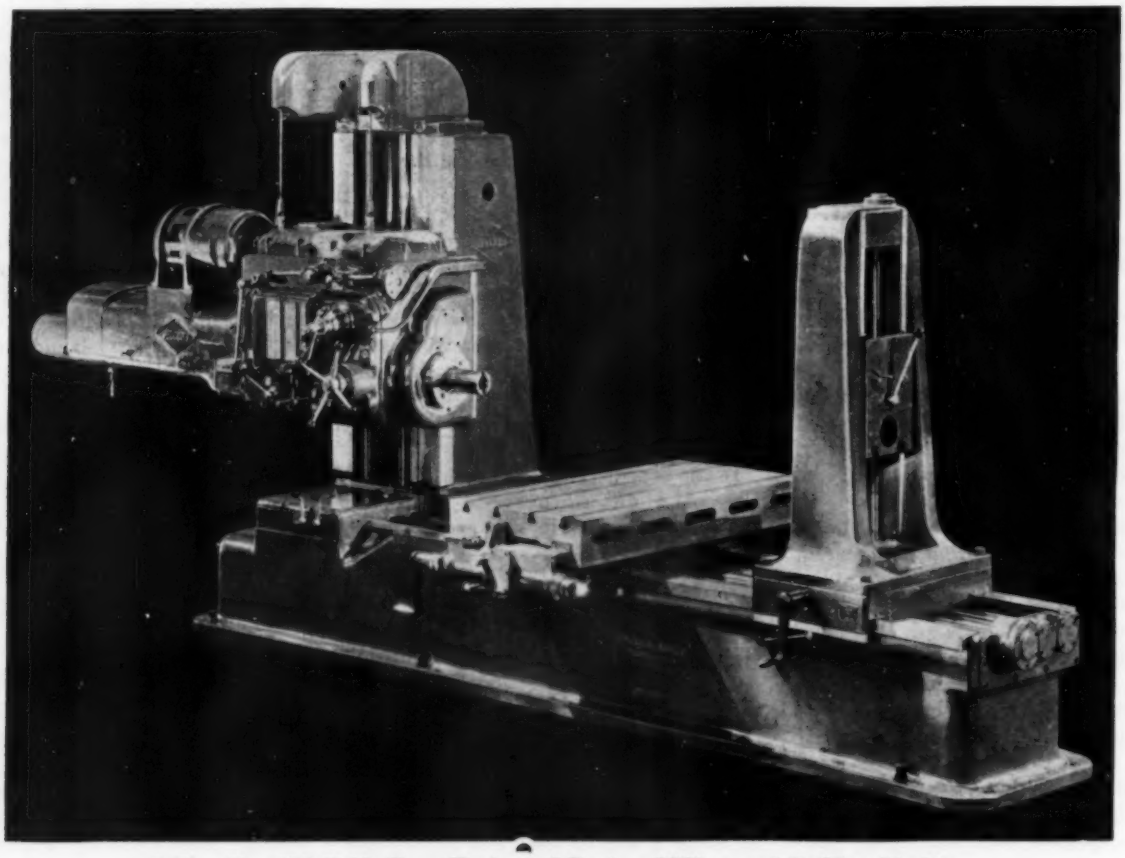
SHOP EQUIPMENT NEWS

Sellers No. 400 Horizontal Boring, Drilling and Milling Machine

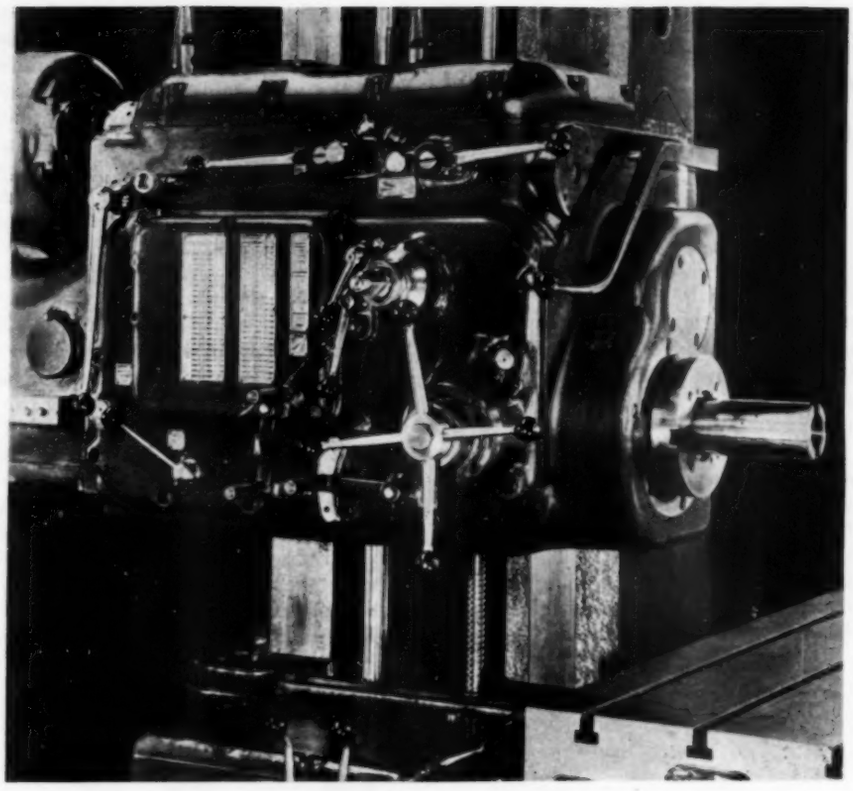
When Wm. Sellers & Co., 1600 Hamilton St., Philadelphia, Pa., built their first horizontal boring machine, 60 years ago, the outstanding feature of the design was the unit head. The same feature distinguishes the first 4-in. spindle machine, the No. 400, just announced. As will be evident from the illustrations, the motor is mounted directly on the head in order to secure the shortest drive to the spindle with the smallest number of gear contacts. Inclusion of the drive, feed and traverse mechanisms in the head permits the concentration of all control levers on the head, and results in an addition of weight that adds materially to the rigidity of the machine under cut.

The feed gears are mounted on the front plate of the head and are removable with it for repair or adjustment without disturbing the rest of the head mechanism. Similarly, the speed gears are mounted on the top of the head which is just beneath the oil-tight fake cover visible in the illustrations.

The drive from the 10-hp., constant-speed, a.c. or d.c. motor is through heat-treated, chrome-nickel steel gears and alloy steel shafts supported on anti-friction bearings. Multiple-spline shafts carry the sliding gears. A friction clutch reversing mechanism in the drive permits quick starting, stopping and reversal of the spindle and feed, a feature advantageous in tapping. A lever located close to the spindle end operates the clutch mechanism and also controls the direction of traverse. There is, in addition, the conventional feed and traverse lever operating the traverse in the opposite direction to the feed. The spindle is moved by a leadscrew and nut. Rapid hand advance is by the handwheel shown, slow hand movement by the square end shaft just above, for which a safety crank is provided. A micrometer dial indicates the extent of spindle movement. All feeds are operated from the head motor driving through a spline shaft close in to the face of the upright. This permits hand movement of the head, spindle and saddle



Sellers No. 400 Table-Type Horizontal Boring, Milling and Drilling Machine employs the unit-head principle. All controls are located on the head



Close view of unit head of Sellers boring machine showing convenient grouping of all speed, feed and traverse control levers and the hand wheel and square shaft for manual operation

from the crank on the head. It also permits operation of the feed or traverse of any of these movements, and also of the table, from the head. Pick-off gears can be provided for thread leads from 1 to 20.

Nitralloy, hardened to 750 Brinell, is used for the spindle, which is carried in two equally hard nitralloy bushings at the front and rear of the spindle sleeve. The sleeve itself is chrome-nickel steel, and is provided with a 10-in. flange carrying 1-in. square keys for driving milling cutters up to 15 in. in diameter. It is mounted in precision tapered roller bearings. Two 16-in. keys, as near the cutter end as possible, key the spindle to the sleeve. Chip guards and oil seals are provided to keep out chips and dirt.

The column is 36 in. across the ways, of box-type construction, internally ribbed. It has a spread at the foot of 42x36 in. The head counterweights travel inside the column and are hung on wire rope. Box-type construction is also used for the bed. The lower flange is provided with leveling screws. All castings are of semi-steel, scraped to fit.

Specifications of No. 400 Horizontal Boring, Milling and Drilling Machine

Diameter of spindle	4 in.	Distance top of table to center of spindle, minimum	1½ in.
Morse taper hole in spindle	No. 6	Distance top of bed to top of table	10 in.
Traverse of spindle	60 in. (2x30 in.)	Size of table	30 in.x60 in.
Number of speed changes	24	Cross travel of table	46 in.
Range of spindle speeds	9 to 500 r.p.m.	Longitudinal travel of table	38 in.
Number of feed changes to any unit	24	Speed of power rapid traverse (per min.)	90 in.
Range of feed to any unit	0.0025 in. to 0.625	Motor	10 h.p.
Maximum distance face of spindle sleeve to outboard support	72 in.	Motor, a.c. or d.c. constant speed	1,750 r.p.m.
Vertical adjustment of head on column	31½ in.	Net weight (approximately)	26,500 lb.

ATTACHMENTS THAT CAN BE FURNISHED WHEN SO ORDERED

Circular swiveling table, diameter	36 in.	Star feed facing head for diameters up to	24 in.
Square swiveling table, size	25x25 in. or 36x36 in.	Cutting compound system, including tank, motor-driven pump, piping, etc.	
Auxiliary tables (length and width)	5x5 in. or 7x5 in.	Inserted-tooth face milling cutters	
Boring bars—any diameter up to	4 in.		

The table is of double plate construction with transverse ribs 11 in. apart. It travels on a box-type saddle equipped with square-lock ways. The distance across the ways is 26 in.

A large-diameter fixed screw and rotating nut provide for table travel. Hand adjustment is provided from either side of the table by means of squares and micrometer dials on the front end of the saddle. Equalized clamps clamp both sides of the table to the saddle. They are located in line with the spindle so that when the table is near the end of its stroke the clamp will be just as effective as when it is at the center. The saddle is also provided with equalizing clamps working on the front and rear ways of the bed where they will obtain the greatest leverage when the table overhangs.

T-slots for ¾-in. bolts are machined in the table. Four slots suffice for the 30x60-in. table, while the 40x60 in. table has six.

The outboard bearing for the bar moves in unison with the head, but there is a separate hand adjustment to realign it if necessary. The column for the outboard bearing is removable from its base to accommodate long work with little loss of time. The base itself is movable by hand along the bed.

Pressure lubrication provides a constant oil bath for all moving parts in the head. Other parts, such as the table and saddle, which move intermittently, are arranged with central reservoir and one-shot lubricating systems.

Swivel Table Features

The auxiliary table is 5 in. wide and 5 ft. or 7 ft. long as required by the customer. It has a T-slot running through its entire length. The swivel table is worm driven and graduated in half degrees on the periphery. It is mounted on the base plate with an elevating, anti-friction, thrust bearing to facilitate quick movement by hand. Lock bolts are provided at 90-deg. intervals, and it is clamped with a single-control clamp mechanism. The working surface of the table is 25 in. x 25 in. and provided with T-slots.

The cutting compound system consists of a separate motor-driven pump and tank in the base of the bed. When this is required the table is provided with a deep trough completely surrounding the working surface with provision to guide the compound down through the saddle into the bed between the ways. From the top of the bed there are channels to lead the liquid to a trough at the back of the bed, from which chips may be removed and where the compound will be collected and drained to the tank.

Cincinnati "Hydro-Broach" Vertical Duplex Broaching Machines

The Cincinnati Milling Machine Company, Cincinnati, Ohio, now offers complete broaching machine equipment for any kind of surface broaching. The vertical duplex broaching machines, which make up the "Hydro-Broach" line are built in three sizes of 2, 5, and 10 tons capacity, each having a normal and extended stroke. General specifications are listed.

Features of these broaching machines are; fast cycle; completely hydraulic, continuous operation with automatically indexed work table; simple, rigid construction, long tool life; convenient working height; automatic lubrication, and simplicity of work-holding fixtures.

The columns carrying the rams are mounted on a large base which contains reservoirs for cutter coolant and the oil used in the hydraulic system. The machines are of the duplex type; one ram goes up while the other comes down. A horizontal work table indexing around a vertical axis, is mounted in front of the two moving rams.

Indexing of the table is controlled by a hydraulic mechanism interlocked with the operation of the vertical rams. The broach on the descending ram engages the work in the fixture which has been indexed to the cutting position, while the fixture on the opposite side of the table has been indexed to clear the broach on the ascending ram. At the completion of the cutting stroke of one ram and the return stroke of the other ram; the rams stop, the work table indexes, the rams reverse their direction of movement, and the cycle of operation repeats itself. Indexing time is small. Practically continuous production is obtained, the operator removes and replaces work in one fixture while the work in the other fixture is broached. A rigid support is provided for the work table which indexes on hardened and ground plates supported by the massive fixed knee.

The automatic cycle is a pace setter for the operator. He may find that he cannot keep up with the machine, in which case the machine may be stopped immediately by kicking the treadle bar with either foot from any position on the platform. The ram movement can be reversed if so desired after stoppage by exerting pressure on the hand lever located on either side of the fixed knee,

The table is accelerated and decelera-

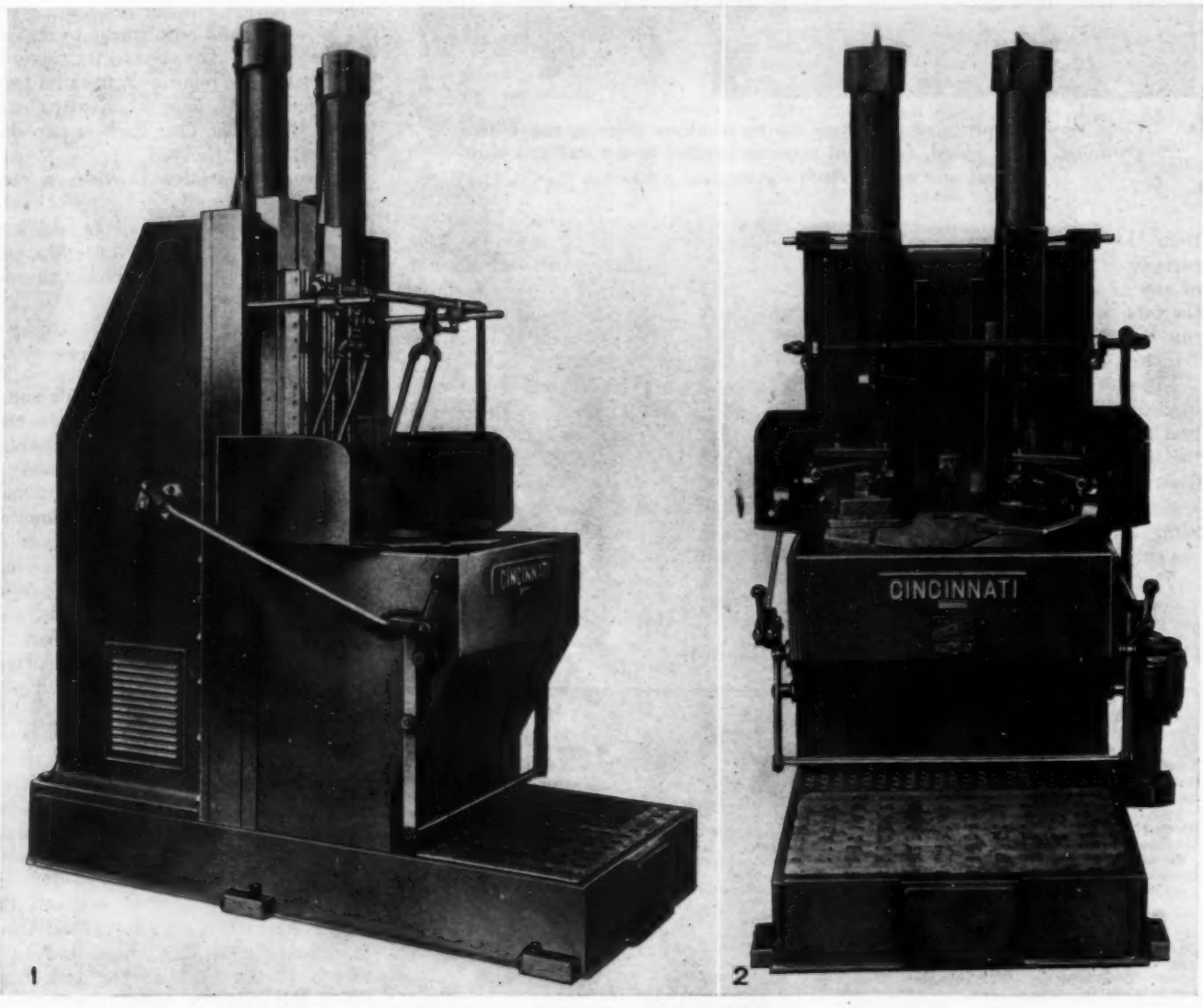


Fig. 1—Cincinnati No. 5-42 Duplex Vertical Hydro-Broach. Fig. 2—Cincinnati 10-54 Duplex Vertical Hydro-Broach arranged for broaching three boss faces of a shock absorber arm

Specifications for Cincinnati "Hydro-Broach" Machines

Machine Sizes	2-36	2-48	5-42	5-54	10-54	10-66
Maximum stroke in inches	36	48	42	54	54	66
Maximum broach length in inches	32	44	38	50	50	62
Broaching force for which tools should be designed—lb	5,000	5,000	10,000	10,000	20,000	20,000
Each machine can be supplied with pumps and motors to give ram speeds as given below:						
Ram Speeds:						
1. Speed, ft. per min	24	24	20	20	21½	21½
H.P. of 1,140 r.p.m. motor	7½	7½	15	15	25	25
2. Speed, ft. per min	34	34	31	31	27.7	27.7
H.P. of 1,140 r.p.m. motor	10	10	20	20	30	30
3. Speed, ft. per min	38	38	41.4	41.4	37.2	37.2
H.P. of 1,140 r.p.m. motor	15	15	25	25	40	40
Overall Height	9'1"	11'1"	9'4"	11'4"	11'8"	13'8"
Net Weight, lb	10,000	11,000	13,000	14,000	17,000	18,000

ted during indexing without shock, by means of hydraulic pressure. The ram slides are moved by hydraulic pressure as described above, supplied by a standard hydraulic pump, directly connected by a flange coupling to a constant speed motor.

Ram ways, table bearings and indexing mechanism are automatically lubricated. The valve mechanism and hydraulic pump are self-oiling. A standard motor driven cutter coolant pump with 20-gal. capacity supplies a copious amount of cutter coolant to the broaching cutters.

Gorton Duplicating Machine for Small Dies and Molds

The George Gorton Machine Co., Racine, Wis., has introduced a line of duplicating machines to reproduce small dies used for die castings, small drop forgings and molds used in rubber, glass, plastic and similar industries. These duplicating machines are manually operated and consist of Gorton vertical milling machines equipped with a tracing arm at the right of the cutter spindle, and a special table mounted on top of the standard milling machine table, and running on special compound ball-bearing slides.

With his left hand the operator controls the movement of both milling cutter and tracer spindles, raising or lowering them as the tracer point follows the contours of the master or die to be reproduced. With his right hand the operator moves the duplicator table laterally in any direction, causing the cutter to mill out the die as the tracer follows the shape of the master. This die or master may be an actual working die, or a master made of brass, bakelite, fusible alloys, or some of the newer materials for plastic reproduction.

Accuracy of work depends upon the accuracy of the original master. This accuracy can be reproduced within limits of 0.001 in., or closer in small areas. The master table is provided with built-in micrometers for shifting the die accurately during process of reproduction, should slight changes in position of various sections be desirable on the new die, Similarly, portions of several originals may be combined in a new die, or sections left off entirely. Holes for ejector pins can be located from the old die and spotted for drilling, thus eliminating a jig-boring operation.

These duplicating machines will cut deep serpentine grooves, sharp shoulders, steep angles and difficult shapes generally, including lettering and special trade marks. High spindle speeds, to 12,000 r.p.m., permit the use of cutters as small as 0.025 to 0.030 in. in diameter for fine accurate work, and thus insure smooth finishes with a minimum of hand polishing. For roughing out dies, the duplicator table can be locked and the movement obtained with the milling machine table screws. For this work cutters up to ½ in. in diameter in shank can be utilized.

The duplicator head and table are detachable in 5 min., thus providing a standard milling machine for ordinary work. The duplicator table base is fastened to the milling machine table with four T-slot bolts, and the duplicator lever is adjustable to different lengths, thus permitting the most convenient operating position and variable leverage for heavy or light cuts. All moving parts are made of high-tensile aluminum alloy to reduce weight.

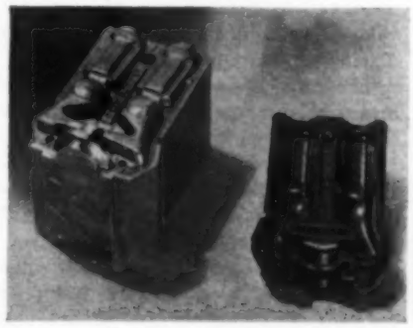


Fig. 2—An insert for a multiple cavity mold produced in 36 hr., including shaper and milling operation and final polishing; actual duplicator time, 18 hr. Punch is made of Nitraloy

Fig. 1—Gorton Duplicating Machine set up for duplicating a plastic mold from a bakelite model. The model is on the master table at the right, while the work is on the table at the left

"Milwaukee" Simplex and Duplex Automatic Milling Machines

"Milwaukee" Simplex and Duplex bed-type milling machines, first introduced by Kearney & Trecker Corporation, Milwaukee, Wis., in 1930, are now provided with complete "two-way" automatic control. With this feature, the table can be operated automatically or manually, or with a combination of both, whichever control is most convenient for the immediate job.

To obtain complete automatic control, a small, compact, hydraulic operator, or control unit, has been designed and is incorporated in the saddle of the machine. This unit affords complete automatic control in a great variety of milling cycles, both one and two-way, with or without automatic spindle stop, depending on requirements.

The two plungers shown at the left and right of the tripping post, lower illustration, control the operation of the unit for automatic reversal of the table and rapid return. At the selected point for automatic reversal, a dog depresses the plunger, slightly opening a valve which causes the plunger to jump ahead under hydraulic pressure. The entire operation of reversal is then made hydraulically at a fast, constant rate, controlling the point of reversal to a fine degree of accuracy, regardless of load.

In previous practice, the clutch was withdrawn mechanically at the feed rate speed. This slow withdrawal of the clutch subjected it to severe strain, and thus greatly limited the accuracy of the point of reversal.

Smooth Rapid Traverse

The automatic reverse is always followed by an instantaneous shift to rapid traverse. An interlock provides that the reverse clutch must be completely engaged before the engagement of rapid traverse, resulting in smooth, quiet operation and avoiding clashing of clutches at rapid traverse speed.

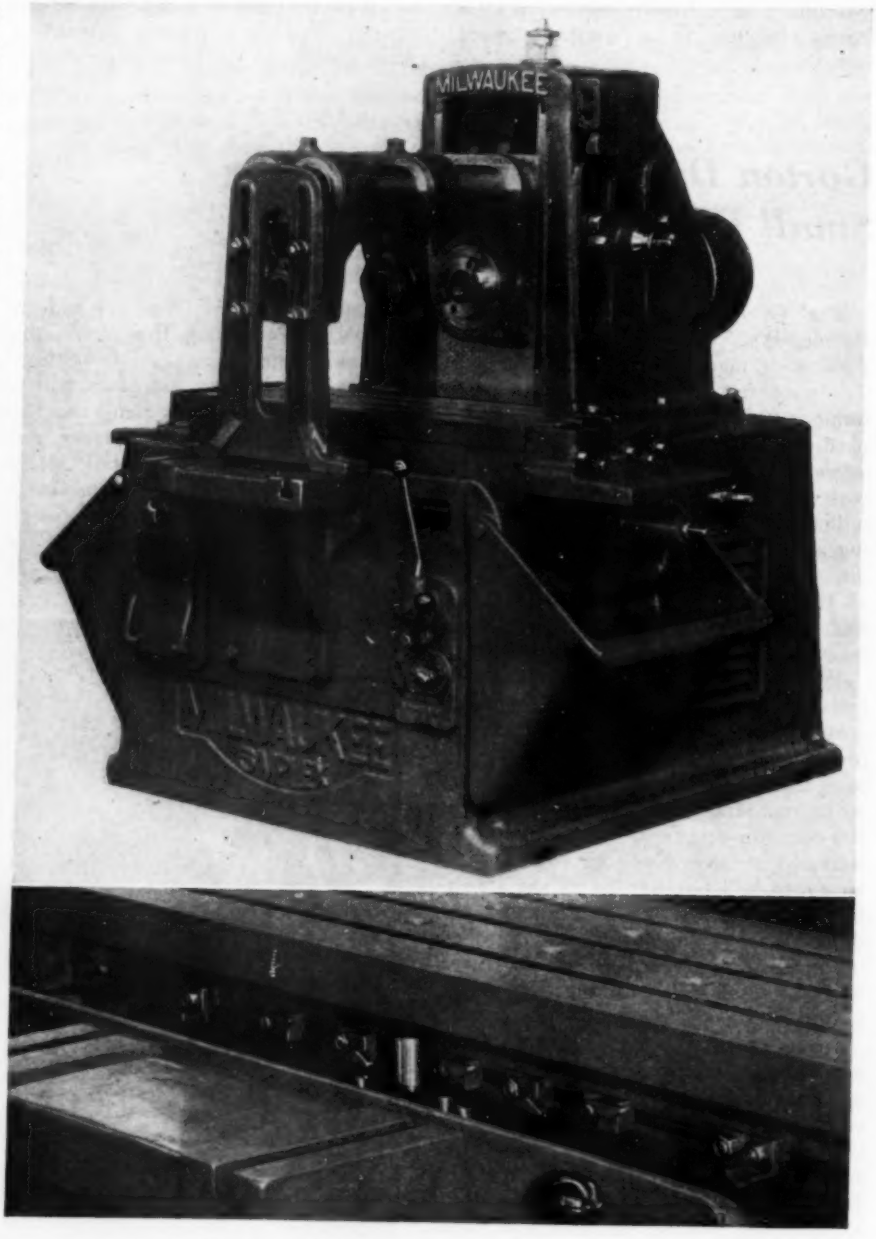
Table dogs and tripping mechanism are fully inclosed in a compartment provided in the front of the table. A sliding cover makes the dogs readily accessible and yet eliminates all dirt, chips, and coolant which would otherwise interfere with the accuracy of the tripping and cause excessive wear on the dogs and tripping posts.

The automatic system provides complete, dog-controlled table movements of any milling cycle desired, to eliminate lost time and speed up production. Automatic spindle stop is available with all of four typical cycles:

1. Feed from right to left, reverse, rapid return to starting point and stop.
2. Feed from left to right, reverse, rapid return to starting point and stop.
3. Approach work in rapid traverse, intermittent feed and rapid traverse, reverse, rapid return to starting point and stop.
4. Continuous automatic cycle, rapid traverse to work, feed, reverse, rapid traverse, feed, reverse.

Automatic spindle stop is available on all Milwaukee Simplex and Duplex machines. A small selector lever, provided at the front of the machine, enables the operator to select automatic spindle stop or conventional control, whichever is preferred for the job at hand. The spindle stop works with both one-way and two-way cycles. When selected, the spindle stops automatically whenever rapid traverse is engaged. To use the spindle during rapid return requires no additional table travel. Therefore, the entire range of feed can be utilized for milling purposes.

The machines are provided with single lever control, whereby rapid traverse,



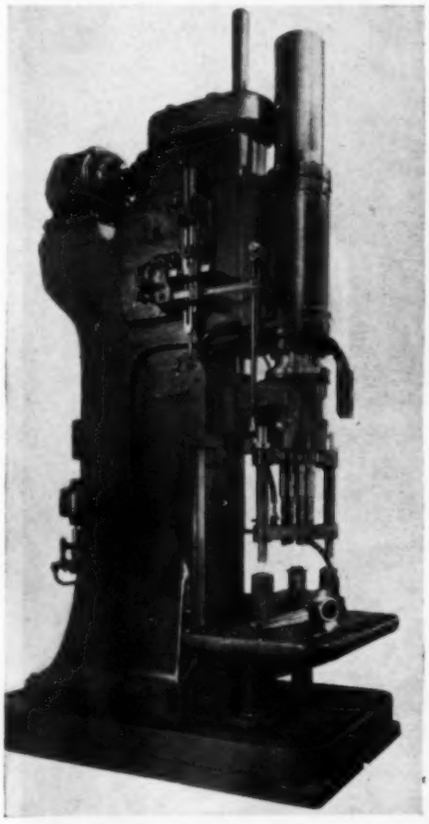
Above—"Milwaukee" Simplex Milling Machine with automatic "two-way" control secured by hydraulic control unit. Below—Two plungers, right and left of tripping post, control automatic reversal and rapid return. Various milling cycles can be secured

feed, and direction, are combined in a single lever. This is the top lever in the upper illustration. The table feeds in the direction in which the lever is moved. Rapid traverse in either direction is obtained by pulling the lever outward. The second lever engages and disengages the main clutch and has "start" and "stop" positions. The machine has "live" rapid traverse, whereby the table may be rapid traverse in either direction with spindle and feed mechanism stopped. The bottom lever is for selecting automatic spindle stop or conventional control. It has "on" and "off" positions designated.

When a machine is to be used for climb cutting, a hardened screw and special take-up nut is furnished at an additional cost. Any one of three feed ranges is obtainable. There are 18 changes within each range: ½ to 20 in. per min.; 1 to 40 in. per min.; 2½ to 100 in. per min. The four speed ranges available are: 20 to 135 r.p.m.; 40 to 270 r.p.m.; 75 to 500 r.p.m.; 150 to 1,000 r.p.m. There are ten changes of speed in each range.

Barnes "Hydram" No. H-3½ Hydraulic-Feed Drilling Machine

For production work in boring, reaming and facing operations, the Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill., is offering the No. H-3½ "Hydram" hydraulic feed drilling machine with capacity from 3½ to 4 in. in solid forgings. The machine can make use of any layout of multiple heads. The machine illustrated is shown fitted with a 9-spindle auxiliary head for drilling in one set-up the master connecting rod for an aircraft motor. Eight of the bores are 22.5 mm. in diameter, and the ninth bore is 18.41 mm. in diameter.



Barnes "Hydram" No. H-3½ Drilling Machine of 3½ in. capacity in solid forgings. A drill head is shown fitted to the machine for drilling nine holes in an aircraft connecting rod

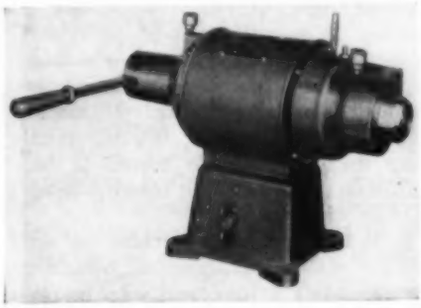
By special adaptation the Hydram unit can be arranged for cylinder boring and also for independent use in other applications quite apart from the machine frame, such as a separate drilling head for vertical, horizontal or angular use on any other machine having a hydraulic pump.

The "Hydram" unit applies hydraulic pressure directly over the center of the multiple head or the cutting tool, because the hydraulic ram carries the spindle. The short saddle on the column takes only the torque of the drive shaft. Furthermore, driving power goes directly to the cutting tool with a minimum of torsional vibration. This is accomplished through reduction of speed from a vertical drive shaft to the comparatively short spindle of large diameter by means of a gearcase carried on the nose of the ram. Rigidity of the sleeve or ram, which is of equal length on either side of the piston, gives support in the upper bearing and lower bearing within the entire spindle travel. Thus, the construction absorbs lateral strains through the large diameter ram.

Specifications: Capacity, high speed drills in SAE No. 1035 steel, up to 3½ in. in diameter; swing, 32 in.; height of machine overall, 148 in.; distance, face of column to center of table, 16¼ in.; maximum distance from spindle to regular table, 33 in.; maximum distance from spindle to base, 49½ in.; table working surface, 34x21½ in.; diameter of spindle nose, 4½ in.; vertical travel of spindle, 20 in.; floor space, 48x76½ in.; motor, 25 hp., 1,200 r.p.m.

"Ideal" Speed Lathe

The Schauer Machine Co., Cincinnati, Ohio, is now supplying its "Ideal" speed lathe with hand- or foot-operated collet chuck. This arrangement makes it possible to handle lapping, finishing or polishing operations on small parts where high daily output is required. The lathe embodies a two-speed, totally enclosed, dust-proof motor, automatic brake, ball bearings and collet chuck taking up to 1-in. diameter round stock.



The two-speed motor provides 1,350 and 2,700 r.p.m. on a.c. High or low speeds are selected by means of a switch in the motor base. Stopping of the motor is effected in two seconds. The action of the brake is instant but smooth and gradual. The collet chuck can be operated with motor at rest or running by means of a hand lever or pedal. Wheel or stepped chucks can also be provided for the polishing or finishing of rings such as ball bearing races and spinning rings.

Osgood "Balanced-Grip" File and Tool Handles

A soft-grip handle, said to be indestructible, has been introduced by the J. L. Osgood Machinery & Tool Co., Inc., 43-45 Pearl St., Buffalo, N. Y., for use with files and other tools. The shape of the handle affords better gripping, prevents slippage forward under severe cuts, and reduces tiresome gripping tension. The handle is furnished in the "Super-Strong" or "Junior" type of construction. In the former a long steel, double-flanged ferrule is forced into the interior of the handle. The shank is easily seated and rigidly held. In the Junior construction a single-wall ferrule is employed, and in the interior an anti-split, shank-pressure resisting ring is fitted.

Heald Style No. 46A Bore-Matic Double-End Precision Boring Machine

The Heald Machine Co., Worcester, Mass., has announced the Style No. 46A "Bore-Matic" designed and built for mass production either of an individual part, or where there are a number of operations to be performed on one piece, or where there are a large number of different pieces that can be handled at a single setting. Maximum diameter of hole bored, 6⅛ in.; minimum diameter of hole bored, ¼ in.; maximum length of hole bored depends on hole diameter.

It is a double-end machine of unusually sturdy construction, weighing approximately 5 tons, and with bridges having a capacity of four boring heads. Although its massiveness alone would absorb practically all normal vibration, care has been used in the design of the various units, to prevent the slightest vibration being transmitted to the boring spindle or work. This includes vibration dampeners under the main drive motor and pump, flexible connection between the pump and the hydraulic system, multiple V-belts, and solid heavy castings throughout. The large oil reservoir spread over the entire lower portion of the base rapidly dissipates through the extensive wall surfaces the heat obtained from the oil.

Centralized Electrical Controls

The base weighs 4,600 lb. It rests on three pads. Extending nearly the entire length of the base are wide V- and flat-ways, covered at all times. All electrical controls, including the fusible disconnect switch, are mounted in one common cabinet in the left end of the base, with aluminum cover interlocked with switch. A cored passage through base is provided for wiring to the motor and to a junction box.

The top of the table is of tray design, confining the lubricant and borings within its limits. A finished pad in the center has three longitudinal T-slots to provide for mounting and clamping the work fixtures in place. Multiple V-belts drive the boring heads from the clutch and brake units. Boring speeds can be varied from 360 to 3,270 r.p.m. by changing pulley sizes. Bridges are wide enough to take four of the No. 9 and No. 11 heads. Locating buttons are provided on the surfaces of the bridges for lining up the boring heads. Distance between the bridges on the No. 46A is 33 in., the standard maximum table travel is 14 in. Boring stroke at one end of the machine may be as much as 8¼ in., but not more than a total of 13 in. on both ends. Should more room be required provision has been made for mounting the bridges back for two 2¼-in. steps on each end to give spacings up to 42 in. between the bridges. Extended machines, similar to the standard machines, are limited to 13 in. maximum stroke. Should a longer stroke be necessary, provision has been made in the base for substituting a special cylinder giving 23 in. table travel, which can only be used with the machine having 42 in. between the bridges. With this arrangement a boring stroke of 22 in. is obtainable with 14 in. as the maximum at one end.

The clutch and brake units for starting and stopping the boring heads are of the direct-hydraulic, self-adjusting type. Braking is maintained on heads when idle. This allows adjustment of the tools more readily, also allows jogging of the heads by hand manipulation of the clutch knob between "run" and "automatic."

Operating controls for the entire machine are located within a small radius on the front of the base. This includes motor start and stop buttons, table controls and boring head controls. The adjusting knobs for boring speed, facing speed, dwell and for hand control of boring heads are located at side of control assembly adjacent to the boring cycle and the heads they control.

The main control unit is built up of separate units for the various functions, all mounted upon three flat plates. This plate construction allows removal of any one of the various units for inspection or alteration of the cycle without disturbing any of the piping. Cams start the boring heads slightly in advance of the reduction to boring speed. Therefore, special cams may be made to jump

Weighing 5 tons, the Heald No. 46A Bore-Matic is a heavy-duty machine having bridges mounting four boring heads and built to eliminate vibration

gaps at high speed without any hesitation in boring head speed.

To change from one cycle to another requires only the substitution of comparatively simple and inexpensive parts such as valve plungers, pipe plugs, and shoulder pins rather than complicated valve bodies or new units. Any additions or changes of cycle may be readily accomplished in the customer's own shop.

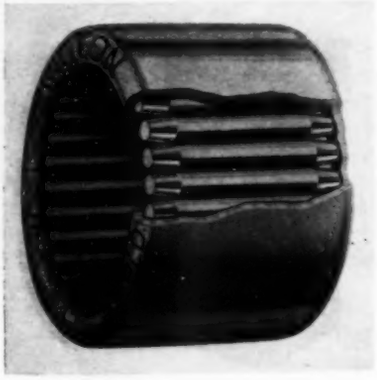
By an entirely new control of the reversing valve with the introduction of a neutral position in its travel, the table is allowed to drift into a positive stop for facing, the boring heads are stopped, with sufficient allowance for cleaning up a facing cut. The facing tools are thus not allowed to idle in contact with the finished work to dull their edges. The timing or dwell control of the stopping of table and heads is by knobs at adjacent end of reversing valve. This dwell control is effective on the movement of the reversing valve only to the neutral position; the starting of the table by the operator in opposite direction is instantaneous by movement of a latched reverse lever.

Should it be desired to set up machine as a single-end machine, with either short or long stroke, the intermediate stop valve may be set to stop the table for loading just inside the outer reversing point, or dog adjustments may be made to secure positive stop without reversal at outer position.

Torrington Needle Bushings

The Torrington Co., Torrington, Conn., has developed a needle bushing that takes no more space than is required for bronze or babbit bushings, and which incorporates the principle of a roller bearing. Because of the use of needle rollers, together with the turned-in ends or lip construction of the shell, there is a large storage capacity for lubricant. Due to a full complement of rollers, a large radial load-carrying capacity results. Use of loose rollers around the shaft has been quite general but they are difficult to assemble. And when disassembling, the rolls are apt to drop out and become lost. The Torrington needle bushings are a complete unit, thus saving time in assembly and permitting easy disassembly.

The outside shell is made of drawing steel, cyanide hardened to give a long-wearing bearing surface. Needle rollers are made from high-carbon steel hardened to 58 to 60 Rockwell C. The bushings are made in bore sizes of ½ to 1¾ in., outside diameters, of ⅝ to 2⅛ in., lengths range from ½ to 1½ in.



Porter-Cable Type D-5 Tungsten-Carbide Lapping Machine

The Porter-Cable Machine Co., Syracuse, N. Y., has superseded its Type D-4 lapping machine with the Type D-5 illustrated. The machine is offered for lapping the cutting edge on tungsten-carbide tools as well as high-speed steel tools used for work on softer metals. A special ball-bearing vertical motor is mounted inside of the housing. Speeds are quickly changed by shifting the V-belt to different steps on the V-pulleys. Speeds obtained are 600, 900, 1,200 and 1,800 r.p.m. with an 1,800 r.p.m. motor. Although the illustration shows the adjustable carriage with an adjustable rail, the machine can be supplied without it. Purpose of the carriage is to hold the tool being lapped at the proper angle, and with correct pressure. A special iron disk, 11¼ in. in diameter, made of Belgian iron, is furnished as standard equipment. When used with an abrasive disk cemented to the cast-iron disk, the machine can be used for removing burrs and for other types of free-hand grinding after milling, pressing, stamping and screw machine operations.

Ex-Cell-O Adopts New A.S.A. Bushing Standard

The Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., will have available from stock after September 1, the new A.S.A. standard jig bushings shown in the Reference Book Sheet, pages 613 and 614 of this number. In accordance with a decision made between the bushing manufacturers, the old standard bushings will be carried in stock for a reasonable length of time to enable manufacturers to obtain replacements of this standard.

Niagara No. A-3½ Inclinable Power Press

The Niagara Machine & Tool Works, Buffalo, N. Y., has added to its line No. A-3½ inclinable power press with a semi-steel cast frame. Main bearings in the frame are tied together by webs and constructed so that the pressure from the crankshaft is transmitted directly to the frame. On geared machines, a unit assembly consisting of a tube in which the anti-friction bearing backshaft is mounted passes through bored openings in the frame aligned with the crankshaft. The tube forms a sealed lubricant reservoir for the bearings.

The slide is guided by two removable gibs provided with take-up for wear. Ways are lubricated by oil cups. The presses are built with an improved pin-type clutch with four engaging points, positive stop to prevent repeating and an indicating arrangement on the brake to show when the proper adjustment and operation are obtained.

"Perliton" Liquid Carburizer

A depth of case from skin hardness to 0.04 in. can be secured with "Perliton" liquid carburizer developed by the E. F. Houghton & Co., 240 West Somerset St., Philadelphia, Pa. The surface can be ground and leave a flat hard surface providing the grinding does not extend beyond the eutectoid area. The advantages claimed for Perliton include: Uniformity in depth of case and carbon content; low cost per ton of steel; longer pot life—up to 1,200 hrs.; no decarburization; non-hygroscopic; high thermal conductivity; no variation in degree of fluidity; reduced heating time, and no rust after water quenching.

Etna Swaging Machine

The Etna Machine Co., 3400 Maplewood Ave., Toledo, Ohio, has redesigned its line of swaging machines. A medium-sized machine is illustrated and is typical of the line. The head is heavily constructed with a heavy steel band shrunk on the outside to counteract the swaging load. The spindle is hardened and ground all over and mounted in two Timken bearings and one radial ball bearing in the rear of the flywheel. A complete lubricating system circulates oil through the head, and foreign matter is separated out in the tank. The motor is mounted in the base of the machine on an adjustable bracket that affords proper tension in the Texrope belts. Another feature is the guard provided for the flywheel and belts to assure compliance with safety regulations. As the starter is also mounted on the machine and wired to the motor, the machine is ready to run upon bringing down lead wires.

Etna swaging machines are made in capacities from ⅜ to 6 in. in diameter, and with dies from 1 to 18 in. long. They are made in the 2-die and 4-die types.

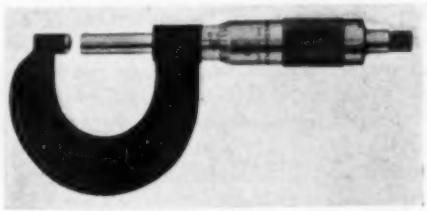
Pratt & Whitney Motor Driven, 2-Speed Gearbox

A complete motor drive unit is now available from the Pratt & Whitney Co., Hartford, Conn., for use with its bench lathe. The motor is mounted beneath the bench on a hinged platform so arranged that the driving belt is tightened by adjusting the platform. The belt goes up through a slot in the bench to a driving pulley inside the unit, and the drive is through a 2-speed gearbox to a 3-step cone pulley corresponding to the one in the headstock of the lathe. The entire unit is ball-bearing mounted. Hardened and ground gears run in oil. A lever on the front engages the unit if either the low or the high speed is desired and provides a neutral position. A ½-hp. motor produces cone pulley speeds of 205 and 820 r.p.m., and six spindle speeds ranging from 145 to 1,400 r.p.m.

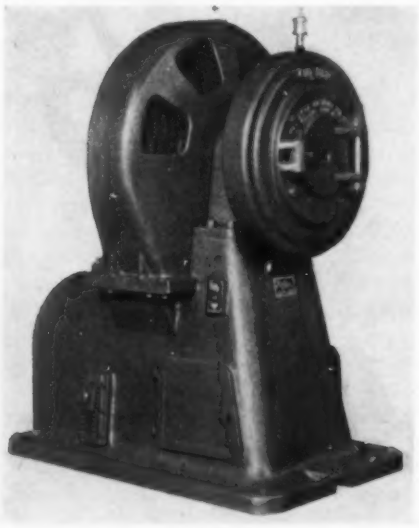
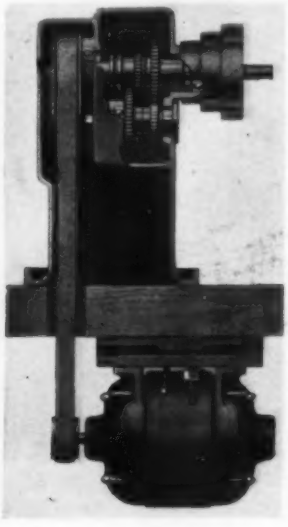
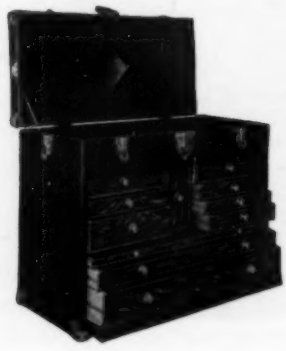
When a high-speed drive for the grinding attachment is needed, the top cover of the motor drive unit is replaced with a long bracket and jack shaft arrangement. An extra pulley is placed on the shaft with a 3-step cone pulley and is used to drive the jack shaft which in turn drives the high speed grinding spindle through a small round belt. The jack shaft speeds are 410 and 1,640 r.p.m. The same unit, with a slightly different pulley arrangement, is used on the Pratt & Whitney universal bench milling machine.

Brown & Sharpe No. 228 Tube Micrometer Caliper

The Brown & Sharpe Mfg. Co., Providence, R. I., has announced the inclusion in its line of a No. 228, tube micrometer caliper, having a range of from 0 to 1 inch, by thousandths. This micrometer caliper accurately measures the thickness of tubing and pipe from 17/32 in. inside diameter upward. It will be observed from the illustration that the anvil is rounded on the end and projects sufficiently from the frame to provide for the easy taking of measurements.



Gerstner Improved Tool Chest

H. Gerstner & Sons, 131 Columbia St., Dayton, Ohio, have added to their line of tool chests an improved and larger model that has a special compartment to hold an *American Machinists Hand Book*.

Another special feature is found in the wide assortment of drawers. In addition to three full-length drawers, the chest contains also seven short-length drawers of assorted inside heights, giving any mechanic with a large kit of tools additional drawer space in which to keep them.